GAS JOURNAL

Vol. 257 February 2, 1949 No. 4470

VESTING DATE : MAY 1

MR. HUGH GAITSKELL announced in the House of Commons on Thursday that "after careful consideration and after consultation with the Gas Council" he had decided that the vesting date under the Gas Act, 1948, shall be May 1, and he proposed to make an Order to that effect. For many months the industry anticipated that it would be taken over on April 1—just a year after the vesting date for the electricity industry—but with several of the Area Boards still not fully constituted it became evident as January passed that there must be some delay, for under the Act the date must be not less than three months after the establishment of the Gas Council *and* all the Area Boards, an Area Board being deemed to be properly constituted if the Chairman and three other members have been appointed.

On May Day of this year, therefore, the 743 statutory, non-statutory, and ancillary company undertakings will, with certain exceptions, be dissolved, and the 275 municipally owned undertakings will similarly pass into the ownership of the Area Boards. The agreements of undertakings will continue to have effect as if the appropriate Board had been a party thereto, an exception being an agreement for the rendering by any person of services to an undertaking as a director, other than a managing director or a director whose functions are substantially those of an employee.

British Gas Stock will be issued in exchange for the existing gas companies' securities, and local authorities will be compensated on the basis of the value of their outstanding debts. It is estimated that £200 mill. will be required for global compensation to pay off stockholders on the basis of Stock Exchange prices and local authorities on the basis of their loan indebtedness. Within the last few days many companies have met to appoint their stockholders' representatives, who will be charged with safeguarding the interests of stockholders in negotiations as to security values. The British Gas Council, which, like gas undertakings, will be taken over on May 1, has taken steps to set up a Gas Stockholders' Representative Committee, which will consider and make recommendations on matters of mutual interest concerning compensation payable.

COMBINED HEAT AND POWER SUPPLIES

THE Institute of Fuel is taking the lead in examining technical problems of fuel utilization. That is, of course, the rightful work of this now august body, which since obtaining its Royal Charter has gone rapidly forward and now occupies a position second to none in the world of general fuel technology. It will be fresh in mind that the Institute made a study of insulation problems, resulting in a number of authoritative papers on the subject which have been published in its *Journal*. The art and science of insulation is progressive, and it was probably wise not to publish more than these papers. Following the study of insulation came an equally comprehensive series of papers and discussions on waste heat recovery. These, edited and partly re-written as the result of the discussions, have lately been published (by Messrs. Chapman and Hall, Ltd.) as a book under the title of *Waste-Heat Recovery from Industrial Furnaces*. We shall not here attempt any appraisement of this work, beyond stating that much of it is of considerable interest to gas engineers, and that in making it available the Institute has performed a valuable public service.

This year the Institute has commenced another study, that of the principles, practice, and problems of combined heat and power supply. Although the title has a "power-station-cum-district-heating" flavour, it touches only slightly on that particular subject. Primarily, it is concerned with the balance between power and process steam (or other forms of heat) in any factory and the best way of supplying whatever is needed in that direction at the lowest fuel and monetary cost and permitting the maximum production of goods in the factory. This subject, in point of fact, has quite a close bearing on the gas industry, and we were surprised not to see more gas engineers attending this interesting meeting. The first day's discussions were devoted to three papers—"Elements of the Heat Balance," by J. Edward, "Heat Balances in Practice," by J. B. M. Mason and L. Clegg (all these three at the time of writing their papers at least were with the Ministry of Fuel and Power), and "Steam Peaks," by Dr. J. M. Ritchie (Director of Steam Engineering at B.C.U.R.A.). The purpose of these papers was to indicate the problems of the factory and how they should be tackled. The first stage in any formulation of policy is to discover exactly what are the problems. The first part of this stage is to discover what is the existing heat balance of the factory or works. Included in that must be the determination of heat balances for the individual process and major items of plant within the factory. It may well be that immense amounts of heat are being wasted because of unsatisfactory plant or unsatisfactory processes or bad methods of operation. Some surprising examples of what can be done in this way were given, among them a laundry which could not raise enough steam to meet its requirements, but after being vetted by a fuel technologist trebled its output with reduced total expenditure of fuel and is now proposing to sell steam to a neighbour! Improvements of so far-reaching a degree are of course not general, and it will hardly be expected that most gas-works can make such savings as these. Nevertheless, some gas-works could make striking improvements in their steam and power utilization; D. T. Barritt and T. C. Finlayson (*Fuel and Future*, Vol. II, 232) have stated: "In the production and efficient use of steam, the coking industry lags behind in that it has not taken advantage of modern technique of steam generation or the peculiar possibilities a coke oven plant offers in making striking reductions in steam consumption." If this is true of coke oven plants, it is equally true of many gas-works.

The first part of the problem, therefore, is to ascertain

how steam and power consumption can be reduced to the smallest possible quantities. That involves setting up a target or bogey figure. There was some divergence of view as to whether there should be a target for each works based on the present plant installed or whether the target should be the ultimate target of what could be done if completely new equipment were to be ordered. The first of these targets is in sight now, and it is therefore practical to shoot at it. On the other hand, works will tend to be rebuilt and re-equipped as it is well that the ultimate best practice should be clearly in mind so that any changes that are made will bring nearer the perfection that should be the objective. There was also discussion as to whether it was possible to set fuel targets for whole industries. It has been done for brewing and for laundry work; with minor modifications to suit local conditions it might be done also for the gas and coking industries. The carbonizing industries have received a plain hint to do something about their fuel and power consumption, and it has been suggested that the Institution of Gas Engineers might set up a committee to report on "fuel, power and steam targets and how to hit the bull's-eye," the report being then presented for discussion at an Annual General Meeting of the whole Institution. Some gas engineers seem to be fully acquainted with the mysteries of pass-out steam and combined heat and power generation; others do not; still others understand the subject sufficiently well, but do not apply their knowledge. The example of Birmingham will be fresh in mind; there, good use is made of steam for power generation and process work, and the surplus power is sold to the electrical distribution system of the town. It is certain that unless measures are introduced to permit of supplying surplus power to the grid on reasonable terms, avoidable waste of fuel will continue. Sir Stafford Cripps has pointed to the need for high rates of production at minimum cost; in this direction lies the road to his objective.

Having put the works in order and achieved the best balance economically possible between power and steam demands, the next question is what to do with the surplus. A second full-day conference is to be held in London on April 27 and in Manchester on May 11 devoted to the discussion of these subjects. "Interchange with the Grid" will be discussed by N. F. Naylor and H. M. Peacock; "Technical Aspects of Interchange with the Grid" by L. D. Anscombe and A. J. Ellison; "Surplus Heat and Power Supply to Adjoining Works" by Dr. G. E. Foxwell and "Co-ordinating Heat and Power in a District" by H. E. Partridge.

MOISTURE IN COKE

AN entertaining discussion has been conducted in *Smokeless Air* over the past two issues on the subject of water in coke. Mr. J. O. Cooke is reported to have made the statement, which is in accord with gas industry views, that "it is generally recognized that a minimum figure of 3% to 4% moisture content is the least which is desirable in a domestic fuel." Dr. G. W. Himus, lecturer in fuel technology, has taken exception to this statement, asking on what grounds it is made. He objects to paying 80s. for a ton of coke out of which between 2s. 4d. and 8s. are for water. If he wishes to moisten his fuel, he says, he can throw his dirty washing-up water on it; moisture and mineral matter are not fuel, and he is hurt at having to buy them at the same price as fuel. Mr. John Roberts has taken Dr. Himus to task; "surely," he says in effect, "Dr. Himus has forgotten the work done in the South Metropolitan Gas Company's laboratories which showed that a minimum of 3% to 4% of water was desirable." All other fuels contain water; why not coke? Dr. Himus remains unrepentant: "As a purchaser of coke nuts for which I am forced to pay over 80s. a ton, I strongly resent buying water, which I can add if I so desire, at the price of coke."

There is the argument. What should be the moisture content of a good domestic coke? We have much sympathy with Dr. Himus and with everyone who has to buy fuel to-day. The inflated price of coal—inflated because of the low output per man-shift in spite of mechanization, and probably because of nationalization—makes us all pay heavily for fuel. When from the total fuel we subtract the moisture and ash the cost becomes almost as high as taxation, which we and Dr. Himus must also pay whether we want to or not. We doubt whether Mr. Cooke was well advised to suggest (if he did suggest) that a *minimum* of 3% to 4% of moisture is desirable in coke. Surely it was Mr. Cooke himself who advocated strongly that we must make a very decided sales effort to sell coke and must improve its quality in order to do so. To suggest to the gas manager that 4% should be the *minimum* is asking for trouble. Let him aim to get the moisture content down to the true minimum, which might well be put at 3%—that being the amount that will keep down the dust during delivery and handling and aid combustion—and the consumer will be getting value for his money. Bone dry coke is not the best value for money! The content of mineral matter is quite another issue. In that the gas industry has no say, nor will have until the price schedule is introduced—if it ever is—and coal is sold on a scientific basis. The gas industry should aim to provide its consumers with the best fuels—best in composition and quality and value.

A NEW APPROACH TO PUBLICITY

In the "Nation's Wealth" exhibition being held at Gas Industry House is proudly displayed the fact that the gas industry is spending £500,000 on research. If money is being spent for the public benefit, then the public should know about it, and so, on Jan. 25 the British Gas Council invited a party of journalists to visit Watson House and see what goes on behind the scenes. Correspondents and Women's Editors attended, representing among them—*Woman's Journal*, *News of the World*, *Britannia and Eve*, *Good Taste*, *Homes and Gardens* and the *Lady*—a fair cross-section of women's literature. The purpose of this visit was to reach the root of any doubt there might be in gas appliances. The medium chosen—women's journals, read at home, read in the train, read in 'buses, read under the office desk—should ensure that this publicity reaches many a new receiver. Untold rewards may be reaped by this new approach. The party was shown tests of all kinds, and many questions were asked. The tentacles of gas now reach further into the homes of the consumers and thanks to the co-operation of the Gas Light and Coke Company many more will know how a portion of the £500,000 is spent for their benefit.

AMERICAN GAS SALES

According to the A.G.A. Bureau of Statistics, last November's sales of the gas utility industry to ultimate consumers were 15% higher than sales during the same month of 1947, increasing from 2,388 million therms to 2,747 million therms. Utility sales of natural gas were up 17.9%, while manufactured gas sales rose 0.9% and sales of mixed gas were 16.1% lower. The Association's November index of total gas utility sales is 210.3 (1935-39 = 100). These percentage changes are influenced considerably by the changeover of several large utilities from the distribution of manufactured or mixed gas to natural gas, with the effect on mixed gas being the most significant because of the small number of utilities distributing mixed gas. In all such change-overs the sales of the utilities concerned are included in manufactured or mixed gas for the period prior to the change, and in natural gas for subsequent months. Total sales of all types of gas during the 12 months ended Nov. 30, 1948, were 32,071 million therms, corresponding to an increase of 10.5% when contrasted with sales of 29,033 million therms in the comparable period ending in 1947. Natural and manufactured gas sales rose 12.8% and 3.9%, respectively, while sales of mixed gas were 18.8% lower. Manufactured gas statistics are developed from data covering ten operating utilities which accounted for 34% of total sales in that branch of the industry in 1947. Information from three utilities, representing 59% of the total sales of mixed gas in

1947, are used in developing the estimates of mixed gas sales. Natural gas data are prepared from reports covering 29 utilities which accounted for 35% of the total natural gas sales to ultimate consumers in 1947.

Personal

Mr. C. R. TROTTER, Manager of the Kennoway and Largo Gas Company since 1942, has now been appointed Engineer and Manager with effect from Jan. 1.

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Mr. H. A. WOOD has been promoted to be chief engineering assistant at Darlington Corporation Gas-Works. Mr. N. HENDERSON has been appointed works superintendent.

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Mr. D. WHITELEY has been appointed works chemist to the Skegness U.D.C. Gas Department. For the past 14 months he has been a technical assistant with the Loughborough Gas Department.

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Mr. GEORGE W. RILEY, a Technical Director of George Scott & Son (London), Ltd., and Ernest Scott & Co., Ltd, and Durie Foundry, Leven, has completed 50 years' service with the firm which he joined as a junior in the drawing office in 1899. A luncheon in his honour was given at the Connaught Rooms, on Jan. 31. Mr. W. Lindsay Burns, Chairman and Managing Director of George Scott & Son (London), Ltd., and Managing Director of Henry Balfour & Co., Ltd., the parent company, presided. The firm's works, originally in Christian Street, Whitechapel, moved to Silvertown, E., in 1918, and subsequently to Scotland. George Scott also have an experimental station—Niobate Works, Blundell Street, Islington, N.7.

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At a meeting of the Yorkshire (West Riding) District Board of the British Gas Council, on Jan. 18, a presentation was made to Mr. C. S. SHAPLEY on the occasion of his retirement from the position of Engineer and General Manager of the City of Leeds Gas Department. Mr. H. E. Bloor, in making the presentation, which took the form of an album containing the signatures of his fellow engineers in Yorkshire, paid tribute to the services which Mr. Shapley had rendered to the industry, and to the co-operation and help which had always been forthcoming to member undertakings in Yorkshire from the Leeds Gas Department. Mr. Shapley had lived for the industry and had been a tower of strength in his untiring efforts for its advancement. Mr. Bloor's remarks were endorsed by Mr. J. E. Lister Cooper and Mr. G. E. Currier. In reply, Mr. Shapley said the book would be one of his most treasured possessions. His work for the industry had been lightened by the loyal co-operation of his staff, and the facilities afforded him by the Leeds Gas Committee.

GAS BOARD APPOINTMENTS

The South-Eastern Gas Board announce that, by arrangement with the South-Eastern Gas Corporation, Mr. R. H. SANDFORD SMITH, F.C.I.S., has been appointed to act as Secretary of the Board. The Board will shortly be taking over offices at 4 and 6, Wandsworth Road, Vauxhall, and in the meantime any communications should be addressed to the Acting Secretary at 1, Grosvenor Place, S.W.1.

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Lieut.-Colonel WILLIAM NORMAN CURTIS, Deputy Town Clerk of Swindon, and formerly prosecuting solicitor to Halifax Corporation, has been appointed Solicitor and Secretary to the South-Western Area Gas Board. Lieut.-Colonel Curtis, who is 35, was educated at Bradford Grammar School and was articled in 1929 to Mr. Percy Saunders, then Town Clerk of Halifax. He obtained an LL.B. (Honours) degree at Leeds University in 1933, and passed the Law Society's final examination in June, 1934, and was admitted a solicitor in the following November. He left Halifax for Swindon in 1940. He was at one time a lecturer in law at Bradford Technical College and at Halifax. He joined the Army in 1942 and served in India, the Arakan, Burma and Batavia.

Obituary

Mr. STANLEY RICHARD CLAY, M.C., a Director of Broom and Wade, Ltd., died in a nursing home in Johannesburg, on Jan. 22, as a result of a chill he caught on his way to visit the Company's South African House. He was 61. He served with the Royal Horse Guards and the Household Battalion during the 1914-18 war.

Diary

Feb. 3.—**Solid Smokeless Fuels Federation:** Executive Committee, 11.30 a.m., Dorchester Hotel, Park Lane, W.1.

Feb. 3.—**Midland Junior Gas Association:** Day visit to the works of the Redditch Gas Company, the Enfield Cycle Company, and the British Cast Iron Research Association. Redditch Gas-Works, 11 a.m.; Foxlydiate Hotel, Redditch, for lunch, 1 p.m.; Works visits. 3 p.m.

Feb. 4.—**Junior Institution of Engineers:** "Mechanical Handling," W. G. Picton, M.Inst.F., and N. A. Jenkinson, 39, Victoria Street, S.W.1. 6.30 p.m.

Feb. 8.—**National Federation of Gas Coke Associations:** General Committee. Gas Industry House, 10 a.m.

Feb. 8.—**British Gas Council:** Central Board, Gas Industry House, 2.30 p.m.

Feb. 9.—**London and Southern Junior Gas Association:** "An Industrial and Commercial Gas Sales Organization," T. V. Garrud, A.M.Inst.Gas E. (Gas Light and Coke Company), Gas Industry House, 2.30 p.m.

Feb. 9.—**Scottish Junior Gas Association (Eastern District):** Visit to the Works of Collvilles, Ltd., Motherwell.

Feb. 11.—**Scottish Junior Gas Association (Western District):** Short Paper Day.

Feb. 14.—**Women's Gas Council:** "The Child in the Home," Dr. Leslie Housden. Gas Industry House, 3 p.m.

Feb. 14-15.—**Women's Gas Council:** Branch Secretaries' Conference. Gas Industry House.

Feb. 15.—**Chemical Engineering Group (Society of Chemical Industry):** "Technical Education," Prof. T. R. C. Fox, M.A., M.I.Mech.E., M.I.Chem.E. Geological Society, Burlington House, Piccadilly, W.1. 5.30 p.m.

Feb. 16.—**Manchester District Junior Association of Gas Engineers:** Visit to the works of R. and J. Dempster, Ltd. "Some Aspects of Gas Development." A. J. Leather (Blackburn).

News in Brief

The North British Association of Gas Managers has issued preliminary notice of its Spring Meeting, to be held in Edinburgh on Mar. 25.

Sunderland Corporation has approved plans by the Sunderland Gas Company for the construction of a new gasholder and additions to the retort house at the Hendon Gas-Works.

Glasgow Corporation, at its last meeting, deferred the appointment of a new General Manager in view of the imminent nationalization of the gas undertaking. An amendment which urged that continuity of efficient management was necessary, irrespective of the transfer, was defeated.

The Inaugural Lecture at Morley College, in a new course on Design in the Home, arranged by the Council of Industrial Design with Morley College was given by Mr. Leslie Hardern, Public Relations Officer to the Gas Light and Coke Company, and Chairman of the Design and Industries Association.

"Alice in Thermland" provides this year's theme for the British Gas Council's pavilion at the Ideal Home Exhibition at Olympia. Last year the exhibit attracted some three quarters of a million visitors. Alice, the Mad Hatter, March Hare, and White Rabbit will all be seen in new adventures with the latest gas appliances. There will also be a wide range of gas-fired equipment on many other stands.

Mr. Hugh Gaitskell, Minister of Fuel and Power, in answer to a question in the House on Jan. 27, stated that he did not intend to postpone any further increases in gas charges and rates until consumer councils have been set up and are operating. Price increases, he said, are only permitted to the extent necessary to cover increased costs, and could not be postponed without loss to the existing undertakings and the future Area Gas Boards.

Remarkable Increases in Output are reported by Mr. W. N. Battersby, Engineer and Manager of the Lakes U.D.C. Gas Department. In Christmas week, 1948, the output was 1,272,500 cu.ft., against 528,900 cu.ft. in the corresponding week of 1938, an increase of 140.5%. The maximum day's output last year was 201,500 cu.ft., compared with 90,000 cu.ft. in 1938. The Council completely renewed the carbonizing plant in 1937-38, when Messrs. Drakes, Ltd., installed stage floor horizontal plant with Morris charger and dilution producer, but it was never anticipated that, in ten years, such a phenomenal increase in output would be called for, especially in view of the fact that there is no industrial load, the increase being entirely due to domestic and hotel consumption. Boosting plant has been installed since 1938 with the result that, in spite of this increase, charts taken on Christmas Day show that, at the peak of demand (Christmas dinner load) the lowest pressure at the extreme end of the district was 45/10 w.g.

HOME SERVICE ADVISERS

At a meeting of the Home Service Advisers' Discussion Group (London District) on Jan. 7, the following officers were elected: *Chairman:* Mrs. Joan Robins, Chief Home Service Adviser, Gas Light & Coke Company; *Deputy Chairman:* Miss Aileen K. J. Wilde, Lady Superintendent, South Metropolitan Gas Company; *Hon. Secretary:* Miss F. M. Cruttenden, Home Service Adviser, Wandsworth & District Gas Company; *Committee:* Miss K. Boswell, Gas Light & Coke Company; Mrs. E. V. Squire, Tottenham & District Gas Company, and Miss J. Houghton, Research Kitchen, Watson House.

Mrs. Eileen Murphy, Home Service Officer, British Gas Council, was elected President of the Group.

LONG SERVICE PRESENTATIONS

Long service presentations were made to officials and employees of the Galashiels Gas Company by the Chairman, Mr. A. Fairgrieve, at a recent dinner, the first function of its kind in the Company's 118 years' history.

The principal recipient was Mr. Frank O'Donnell, who received a clock bearing an inscription which records his service with the Company since 1888. Four of Mr. O'Donnell's sons entered the Company's service as boys and, except for periods of war service, have remained in the Company's employment. The family has a record of 168 years' service. James and Matthew are leading stokers; Frank, Junr., formerly a stoker, is now a collector; and Dominic is a gas fitter.

Others who received gifts were: Mr. John Chapman, Secretary and Treasurer for exactly 50 years; Mr. A. E. S. Thomson, who retired for health reasons from the position as Auditor, after 37 years; and Mr. Hugh Divers, a leading retort operator, who entered the Company's employment in 1913.

Mr. W. C. Campbell, Engineer and Manager, thanked the Chairman for conducting the proceedings and added his thanks to the Directors and all the employees for the support afforded him during his ten years of association with the Company, most of which had been war years with their accompanying trials and tribulations.

GAS SALESMANSHIP AND CONSUMER SERVICE

Regulations for training and examination in Gas Salesmanship and Consumer Service were published in July, 1947, by the Institution of Gas Engineers (Communication 320) and, as was anticipated, have formed the basis of discussion at meetings of many Gas Salesmen's Circles of the British Gas Council in several parts of the country. It became apparent from some of these discussions that the purpose and scope of the scheme are perhaps not fully appreciated and it is accordingly felt desirable, at the risk of repeating what has frequently been written and said elsewhere, to enlarge upon the Introduction to the Regulations in the following brief notes.

The scheme is intended to meet the requirements of the many hundreds of representatives in the gas industry whose function it is to provide a selling and after sales service to the commercial and domestic consumer. Various titles are given by different gas undertakings to personnel fulfilling this function, such as District Representatives, Showroom Representatives, District Salesmen, &c., but, in general, the nature of the duty to be performed is very similar. It is to act as a liaison between the consumer and the service departments of the gas undertaking. Accordingly the representative must be able to recommend the correct appliance for a specific purpose, and should be able to advise as to its use, the maintenance necessary for its proper operation, and should be able to estimate the cost of its installation and its running costs.

A scheme of training for such personnel must, therefore, involve a knowledge of the technique of selling and also a sound, although not profound, knowledge of the installation, maintenance and use of all the many gas appliances likely to be of interest to the domestic and commercial consumer.

It is, perhaps, hardly necessary to stress that there is a distinct difference between the salesmen and representatives of the gas industry, and the salesmen of many commercial commodities such as vacuum cleaners, patent medicines, &c., in so far as the former have to possess a degree of technical knowledge of installation work and after sales service which is not needed by the latter. For the proper understanding of the technology of gas supply, it has been necessary to include in the scheme of training a number of ancillary subjects.

It is felt that the scheme proposed comprises a properly balanced course in these various aspects, although criticism has been offered on the grounds that the award of the certificate does not of itself lead to membership of a professional organization. As has been pointed out, however, candidates wishing to specialize in sales management may proceed to the Associateship Examination of the Incorporated Sales Managers' Association, while those aspiring to higher positions on the technical side should consider the Associate Membership Examination of the Institution of Gas Engineers. It should be appreciated that the academic standards required for both of these qualifications are considerably higher than those proposed for the Certificate in Gas Salesmanship and Consumer Service, so that membership of either body could not reasonably be anticipated merely by reason of possession of the certificate. Further, both organizations require, in addition to academic qualifications, certain professional qualifications which many of the holders of the certificate might not be able to satisfy. Indeed, it is expected that only a small proportion of those to whom the certificate in Gas Salesmanship and Consumer Service is likely to appeal, will wish or be able to proceed to these higher qualifications.

Although there is no direct link between the certificate in Gas Salesmanship and Consumer Service and the two professional examinations to which reference has been made, it should be appreciated that it will serve as an excellent forerunner to both. In the case of the Associateship Examination of the Incorporated Sales Managers' Association, which is the qualification likely to be more generally appropriate, entry for the qualifying examination cannot be made before the age of 19 years, by which time a student who commenced studies upon leaving school should have completed the certificate, or at least have covered most of the course. The Incorporated Sales Managers' Association holds two examinations:—

(1) A qualifying examination, the minimum age for entry being 19 years, and in which candidates must pass in a compulsory subject, commerce, and two of the following: economics, business statistics, commercial law, and principles of accounts.

(2) The final examination, the minimum age for entry being 25 years, which consists of the two parts:—

(a) *Planning the Sales Policy.*
Subjects—market research;
marketing;
budgetary control and sales forecasting.

(b) *Implementing of Sales Policies and Plans.*
Subjects—principles and practice of salesmanship;
sales organization and control;
advertising.

Success in the final examination, which can only be taken after passing or being granted exemption from the qualifying examination, is the academic qualification for Associateship of the Association, the other conditions being that the candidate must be not less than 25 years of age, and must at the time of application have had two years' experience in an approved assistant sales executive position.

"JOURNAL" DIRECTORY 1949

To keep the directory information up-to-date, the following alterations and corrections which have been notified since Dec. 15—the last date covered by the corrigenda slip in the 1949 issue of the "GAS JOURNAL" CALENDAR AND DIRECTORY—should be noted:

Page 14—BRIDLINGTON GROUP, HORNSEA: F. L. Whitehurst, *Res M.*
„ 14—BRADFORD: Delete G. E. Currier, *E & M.*
„ 40—JERSEY: S. P. Pepin, *MD, E & M.*
„ 48—LYDNEY: C. Reid, *M.*
„ 48—MARCH: R. K. Mortimer, *S*, vice C. Greenwood retired.
„ 58—PORT TALBOT: Delete E. M. Edwards, *E & M.* D. W. Rees, *Actg E & M.*
„ 68—SOUTH METROPOLITAN: A. S. Holden, *Joint S.*
„ 72—SWINDON: Delete C. H. Chester, *D, GM & S*, G. F. Oliver, *E.* W. B. Claridge becomes *Actg M*, P. J. Whitehead, *Actg E.*, and H. Wheeler, *Actg S.*
„ 74—TOTTENHAM: Delete H. C. Smith, *Dep Ch & MD.*
„ 82—WOLVERHAMPTON: Delete A. G. Williams, *GM & S.* W. Macnaughton, *GM & CE*, F. Elledge, *S & Acct.*
„ 94—MONTROSE: J. Campbell, *E & M*, vice D. M. Macintyre.
„ 129—HENLEY-IN-ARDEN: Should appear under Warwickshire instead of Worcestershire.
„ 278 and 290.—STAVELEY COAL & IRON CO., LTD.: Name now changed to Staveley Iron & Chemical Co., Ltd.
„ 285, 350.—HILLS PATENT GLAZING CO., LTD., now changed to Hills (West Bromwich), Ltd.
„ 290—THOMAS, RICHARD, AND BALDWINS, LTD.: Address should read: Wilden Ironworks, Stourport-on-Severn.

Darlington Town Council has accepted a £55,000 tender from Cochranes (Middlesbrough), Ltd., for the supply of pipes for carrying coke-oven gas to Darlington from the Evenwood coke-works, a distance of about 16 miles.

AUTONOMY OF THE AREA BOARDS

A HISTORICAL review of the Gloucester Gas Light Company was incorporated as part of the programme for the annual dinner of the Company which was held on Jan. 22. The review outlined the development and progress of the Company from its formation in 1820, as one of the pioneers of the industry, to the present day.

The history recalled that locally the manufacture of gas began at the Quay, but in 1877 more extensive premises were acquired at Hempsted, the site of the present works. The offices remained at the Quay until 1891, when they were transferred to their present premises in Eastgate Street. The number of consumers, domestic and industrial, in 1855 was approximately 1,000. At the end of December, 1947, there were 20,944.

Statistics recording the progress of the Company during the past 18 years showed that in 1920 444,210,000 cu.ft. of gas was sold, the number of consumers was 12,255, and miles of mains numbered 67. The respective figures for 1947 were 1,164,930,000, 20,944, and 133.

At the dinner, attended by over 200 guests, staff and employees, Mr. A. L. Morris (Commercial Manager) mentioned that in 1948 sales constituted another record, rising to 1,231 mill. cu.ft.

Reference was also made in the review to a major development which took place during the last war—the laying of trunk mains to the neighbouring undertakings at Cheltenham and Stroud. The link up with Cheltenham, it was stated, enabled the two undertakings to assist each other with supplies of gas, when required, and assured maintenance of supply. The link up with Stroud had made it possible for that undertaking to give a supply of gas far in excess of its own manufacturing plant. During the past year a trunk main was laid connecting Gloucester with Dursley, through which the Dursley undertaking would receive 100 mill. cu.ft. per annum.

The dinner was attended by Mr. C. H. Chester (Chairman of the South-Western Area Gas Board set up under the new Gas Act). Extending a welcome to Mr. Chester, Sir Leslie Boyce, who, in addddition to being Chairman of the Gloucester Gas Light Company is also Chairman of the Association of Gas Corporations and of the Severn Valley Gas Corporation, said it was no small consolation to his colleagues and himself to know that in this Area they were handing over to a Board headed by a man of such distinction in the gas industry. Mr. Chester had been for many years well known and highly respected in the industry as a progressive and able director and general manager of the Swindon United Gas Company.

Sir Leslie Boyce also reviewed the history and progress of the Company, which, he said, had rendered most valuable and most efficient service to the community. Since the Company became a constituent of the Severn Valley Group in 1934, large sums of capital money had been expended in order to meet modern requirements. Their new vertical retort was believed to be one of the finest and most modern in the world.

Mr. Chester expressed pleasure at meeting some of the employees of the future Area Gas Board, and said he hoped they would be joining a very happy team.

The Area Gas Boards were autonomous, which meant that the South-Western Board was a separate entity responsible directly to Parliament. That responsibility was one which must not be considered lightly by anyone, from the Chairman down to the lowest paid employee in the undertaking. The Board must be successful, and to be successful it must have the hearty co-operation of every member serving it. He was fully conscious of the fact that he could not expect service unless he had a happy team. He hoped that by the education scheme which, among other schemes, he would introduce in the Area there would be room for proper promotion of those who were fitted for promotion.

Mr. Chester emphasized that the success of the Board would be measured by the standard and efficiency of the service they gave to the public, and he stressed that this would be the responsibility of all concerned in the industry. Explaining how the public would be catered for to ensure they had a proper deal, Mr. Chester referred to the Gas Consumers' Councils to be set up in every Area to be a watch dog for the public. The Chairman of the Council would have a seat on the Board, and would hear all the deliberations on policy, staff management, and sales and service which went to make up a gas undertaking. They would also hear where, if ever, he hoped not often, the service fell down in the public eye.

"I shall look rather askance on any Area from which I receive a complaint of bad service," commented Mr. Chester. "We are a public service in every sense of the word. There are no politics, so far as I am concerned, in this Area Board. It exists primarily for the supply of a very essential service to the public, and for the happiness of those who work in that service."

After mentioning that he had been in the industry for upwards of 30 years, and had climbed right from the bottom to where he was now, Mr. Chester said he was appreciative of every problem of everyone in that room. He was also cognisant of the fact that if it were not for the very high sense of duty which had imbued gas administrators of the past from the directors downwards, the present high standard of the gas industry would not exist.

Recalling that dividends had been controlled very largely by the price of gas as supplied to the public, and that a division of profit had been very properly applied to the benefit of the employees, Mr. Chester referred to the co-partnership and profit-sharing schemes. How they would deal with these schemes under the new Gas Act he did not know at the moment, but he appreciated how they had engendered the success of the Gloucester and many other gas undertakings.

During his career he had learnt to respect the care exercised by directors and management for the happiness of employees in the industry. With that tradition behind him, he was very conscious of the responsibility placed upon him as chairman of the South-Western Gas Board, and he hoped that in saying good-bye to private and municipal enterprise in the gas industry there would be no regrets on their part.

ONE THOUSAND GAS-EQUIPPED HOUSES

One thousand gas-equipped houses have now been completed in South Shields Corporation's contribution to the national housing drive. Contact was established with every tenant by a member of the Home Service Staff of the Newcastle-upon-Tyne and Gateshead Gas Company, and general instruction and information given upon the gas equipment.

The Company aimed to provide a high standard of service after the tenant was established in her new home, and plans were made to engage a large hall capable of accommodating 500-600 people for the purpose of giving more elaborate advice on domestic equipment. This was done at a Christmas party attended by the Mayor and Mayoress, who opened the function and by the Housing Committee with its Chairman and all the chief officers of the Corporation. The purposes of the function were: to provide practical instruction on the use of all modern gas appliances installed in the houses on the new estates; to assist young housewives who would be facing the problem of Christmas catering for the first time; to provide facilities for the development of social intercourse among the tenants and an opportunity for the Councillors and their officials to meet *en masse* the tenants whom the Corporation have housed during the past few years.

A separate invitation was issued to every tenant and within a matter of 48 hours it was evident that the hall would be filled to capacity. Mr. J. White of the Newcastle & Gateshead Gas Company welcomed the visitors and introduced the Mayor. A highly specialized demonstration followed, given by the chief Home Service Adviser, Miss Mary Strong.

FITTERS' AND SALESMEN'S LECTURES

A series of lectures to gasfitters and salesmen given in the Lecture Theatre of the Middlesbrough Gas Department has recently concluded, and the interest shown in the programme and the benefits derived from it justified the hopes which prompted its introduction.

During the last twelve months fitters and salesmen from the neighbouring undertakings have met the Middlesbrough staff at regular intervals at these lectures. These meetings of the personnel have not been the least important feature of the scheme.

The series has consisted of 25 lectures, and aggregate attendance has numbered 1,370. The lectures have embraced a wide range of subjects: space heating, water heating, cooking, bread baking, an industrial appreciation of gas and more fundamental subjects such as meters and governors.

Many of the lectures have been given by technicians from the firms of appliance manufacturers, and they have given valuable information on the construction and methods of fitting and servicing their appliances. Others have been given by senior members of the technical staff of the Middlesbrough Gas Department, these being on methods of gas fitting in general, and covering some more important aspects of gas supply. The results of tests on appliances in the Middlesbrough laboratories have been freely discussed, enabling the fitters and salesmen to appreciate the limitation of appliances, so as to help them in assuming the best appliances for the job in hand.

Criticism has been invited at all the lectures and in many cases the manufacturers have expressed appreciation of the difficulties brought to their notice through these meetings.

It is not intended to let the lecture scheme end with this series, but for the immediate future, further meetings will be confined to passing on to the staffs information about appliances which has come to light in the laboratories.

GAS IN FRANCE

(From Our Special Correspondent)

IN the December issue of the *Journal des Usines à Gaz* the Editor looks back over 1948. To what extent have the hopes been realized which were expressed at the beginning of the year ? In the early months a 10-year plan of reconstruction, arising out of the Monnet Plan, had been submitted for the equipment of the gas industry. The *Journal* had urged the importance and the urgency of such a plan not only for the development of an activity which cries out for extension but also and especially for the repair and improvement of works worn by five years of war, some to the point of extinction. Although calculated with an evident care for economy the figures put forward make one think; 586,000 tonnes of iron and steel and nearly 5,500 mill. francs at their 1938 value, say a little more than 70 milliards at present values, for the 10 years 1948 to 1957. Will these targets be reached ? Only the future can tell. However that may be the credits this year put at the disposal of Gaz de France, small though they are, at least enable a start to be made with re-equipment.

A list is given of the new plant and equipment which has been completed or commenced during the year. Operation has recovered facilities which it has not known for a long time. Supplies of coal have permitted on the one hand the raising of the calorific value of gas supply to a level very near to that of pre-war, and, on the other, the accumulation of stocks sufficient to get over without damage the several weeks of stoppage in the mines. Derivatives of petroleum have been largely used, gas oil, which has become a rare and expensive commodity, giving way to other more common products, such as the paraffin distillates, in the hope that one day the heavier oils will be applicable. In the South West natural gas is increasingly distributed in the pure state, at least in the smaller towns, calling for the use of apparatus adapted to it, not without difficulty but with fair success. On the sales side, the re-organized services have shown themselves at every opportunity in displays and exhibitions, where the colours of Gaz de France have been kept flying beside those of Electricité de France.

There remains much to do, many difficulties to overcome, but a start has been made and it is well to survey the work which has been done while the organizations and men are set up in the new regime.

Statistics

M. R. Dury, of Gaz de France, reviews in detail the statistics of the industry for the year 1947 compared with those of 1946. Gasworks and gas-supplying coke ovens gasified 4,296,200 tonnes of coal, 58,600 tonnes more than in 1946. The employment of substitute materials (lignite, peat, wood) decreased from 92,400 in 1946 to 47,700 tonnes in 1947. On the other hand petroleum derivatives used increased from 32,253 to 47,350 tonnes. The volumetric production of gas, 2,466 mill. cu.m., remained stationary. (It increased on a thermal basis.) On the other hand the purchase of coke oven gas increased from 331 to 434 mill. The purchase of natural gas (at 9,000 calories) also increased from 35 to 51 mill., while 106,000 cu.m. of propane at 24,000 calories was also purchased. The distribution of gas sales is interesting. Domestic users took 74.4%, commercial 9.6, industrial 12.8, traction 2.6, public lighting 0.6—a slight decrease in domestic and nearly 30% increase in industrial use as compared with 1946. The total population served was 21 mill. Consumers numbered 4,970,000, of whom 4,858,000 were domestic. Annual consumption per head of population was 127 cu.m. (4,480 cu.ft.); per consumer 532 cu.m. (18,790 cu.ft.), and per domestic consumer 405 cu.m. (14,300 cu.ft.). The last named figure varied widely regionally, being 445 (15,720 cu.ft.) in the Parisian Region, 604 (21,330 cu.ft.) in the North, and as low as 301 (10,630 cu.ft.) in the East Centre. Practically every domestic consumer possesses a gas cooker but only 3.6% use a water heater, 7.8% a bath water heater, 5% a radiator, 0.5% a central heating boiler, and 0.3% a refrigerator.

Some of the figures relating to commercial uses are emphasized. In the field of big scale cooking the average consumption of a canteen or hospital is three times that of an hotel or restaurant. The consumption of bakers represents 23.5% of the whole of the sales of gas under this heading. Finally, large scale space heating increased from 3,890 in 1946 to 5,300 installations in service in 1947.

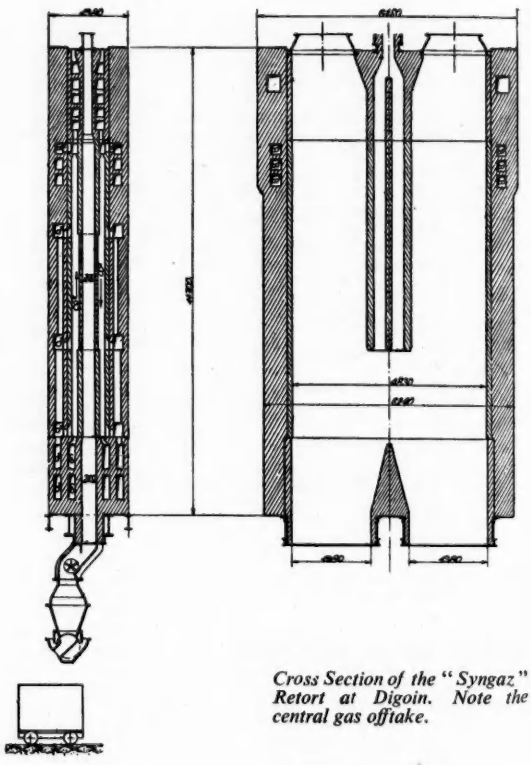
Particular attention is drawn to the decrease in personnel employed in the gas industry, on the sales side amounting to 6.2% in spite of the increase in production and sales. On the manufacturing side, while in 1946 the average tonnage of coal treated per man was 233 tonnes, in 1947 this increased to 264 and it reached 302 for the whole of the works of Gaz de France attached to the Centres Autonomes de Production et de Transport de Gaz.

The statistics for the year 1947 thus show a notable improvement in the activity of the gas industry in all sections. The results of the first three quarters of 1948 confirm this advance, showing a 16% increase in coal carbonized, 2% in gas made by volume, but 12% by thermal content. These increases are attributed to two causes —first the increase of calorific value giving better results in appliances and second the systematic limitation of gas prices. It is the writer's opinion that gas prices are too low in relation to the costs of coal and labour and that the industry will not be able to balance its accounts. It is feared, therefore, that the advances now apparent are in large part artificial. Investigations made during the elaboration of the plan for the equipment of the industry showed, however, definitely, that under normal conditions with well-designed installations and intelligent propaganda a considerable development in the sale of gas could be made in quite a short period, not by way of an abnormal reduction of tariffs, but, on the contrary, with prices integrated with a balanced economy and with gas remaining in its own vast domain.

Lisbon

The description of the new works at Matinha, Lisbon, is continued. The guarantees of the contract were based on the treatment of Durham and Yorkshire coals with 4% ash and 1.5% moisture. Circumstances have rendered systematic tests under these conditions impossible. The coals used, mostly from American sources, have been far from the quality contemplated in the contract.

In the design of the works, in view of the softness of the climate it was decided that certain portions of the apparatus should be left open to the air but sheltered overhead. The condensing apparatus is accommodated in a building in the form of a " great hall " of which a portion is enclosed for the rotary machines. Owing to the nature of the ground the works mains are arranged not below but above ground, with the advantage of easy access.



Cross Section of the " Syngaz " Retort at Digoin. Note the central gas offtake.

From the retort house gas is taken through tubular condensers to automatic mechanical detarrers and thence to exhausters in duplicate groups, one steam and the other electrically driven. These are followed by P. & A. tar extractors and a secondary condenser. Finally an ammonia washer of the static (pump) type finishes the physical purification of the gas. Oxide purification is effected in four boxes 6 by 7 by 3 metres high, erected on a stage for bottom emptying. Revivification *in situ* is controlled by a motor compressor with automatic governor and meter. Purifying material is handled by electric runway and skip arranged over the boxes.

The construction of the new works at Matinha presented a delicate problem in the transmission of gas to the centres of consumption. One point of compression was established in the works with three points of release within the city, to which gas is taken in steel mains. There are three compressors, one coupled to an electric motor, the others to a steam engine. The electrically driven machine has a

capacity of 5,000 cu.m. and the steam driven ones 3,000 cu.m. per hour each, developing a pressure of 5 m. water gauge. The whole is fully instrumented and controlled. The three distributing posts within the city, situated at from 6 to 7.6 kilometres from the works, are fully described.

These works have now been in regular operation for several years. Their successful completion under difficult wartime conditions reflects great credit upon the engineers of the undertaking and of the contractors.

News items include a report of the autumn session of the Institution of Gas Engineers (upon which the Editor comments with favour and interest), the putting into service of the third battery of 15 Koppers ovens at Villeneuve-la-Garenne, and a note by M. Maurice Veillon (whose articles on aesthetics in industrial structures we have been reporting) on the architecture of the new plant at Pontypool. M. Veillon particularly notes the fine Woodall-Duckham retort house, views of which were reproduced in the "GAS JOURNAL" of Oct. 27. He promises to include in his future articles some descriptions of the principal British installations.

Cahier No. 8 issued by the technical service of the Cie. Générale de Construction de Fours describes an experimental station for the production of town gas and of "synthesis" gas from lignites of the Faveau basin. The plant erected at Digoin consists of one full scale unit of Woodall-Duckham continuous vertical retorts. Two retorts are run into one chamber 4,830 mm. (190 in.) on the major axis, with a central gas offtake about two-thirds of the way down the retort, and of the standard length (8 m., say 25 ft.). The lignite contains 8.5 to 9% moisture, and 14.4% ash, with 46% volatiles and 54% fixed carbon on the dry ash-free basis. When making town gas the retort offtake was operated at the top of the retort in the usual manner. For synthesis gas the central gas offtake was used. The production of town gas, in one test, was 350 cu.m./tonne (12,560 cu.ft./ton) at 4,000 calories (say 420 B.Th.U./cu.ft.) and of "syngaz" in another, was 1,030 cu.m./tonne (36,950 cu.ft./ton) at 2,900 calories (say 300 B.Th.U./cu.ft.). It was required that the "syngaz" should have CO/H in the proportion 2:1 and as little CH_4 as possible. In these tests, while the town gas had CO 25.7, H_2 39.4, and CH_4 16.3%, the "syngaz" had CO 27.0, H_2 54.2, and CH_4 only 3.2%. This satisfactory result is attributed to the central offtake giving maximum cracking of CH_4 and an increase in steaming from 8 to 32%. This very interesting and informative brochure should be in the reference of everyone interested in the technical side of carbonization.

STUD WELDING IN THE GAS INDUSTRY

THE manufacture and installation of gas plant and appliances involves the use of screwed studs, nuts and bolts or other means of joining parts together. Such an operation as drilling or tapping for studs takes a long time, and any alternative method which is faster and gives an equally good or better fixing will both reduce production costs and increase output. These advantages can be obtained by using the technique of electric arc welding with a "gun" to weld ferrous studs at the rate of dozens per hour. An important asset of the gun is that it can be used for welding on a variety of different kinds of pins, tubes and similar items—apart from standard studs. This means that often by adopting stud welding it becomes practicable to simplify the design of products, structures, or fixings, or at least allow for modifications giving a better appearance, improved construction and economy of materials. Since the base metal is not perforated the joint between this and the stud is gas, oil, and water tight. Moreover, the additional mechanical strength obtained by not perforating the plate is beneficial in many forms of construction.

The principle of stud welding is to strike an arc between the end of the stud and the base metal, to produce a molten pool, and raise the end of the stud to melting point; then extinguish the arc and drive the stud into the pool to form a weld. This operation takes a fraction of a second.

Stud welding has been employed successfully in metal-working industries for several years, using equipment and material supplied by the Nelson Stud Welding Service, which also has investigated and advised on problems of application. To provide for further development and expansion of the service it is now operated by Crompton Parkinson, Ltd., Crompton House, Aldwych, London, W.C.2. Nelson equipment is designed for use by semi-skilled labour, is portable, built to withstand rough handling and outdoor service.

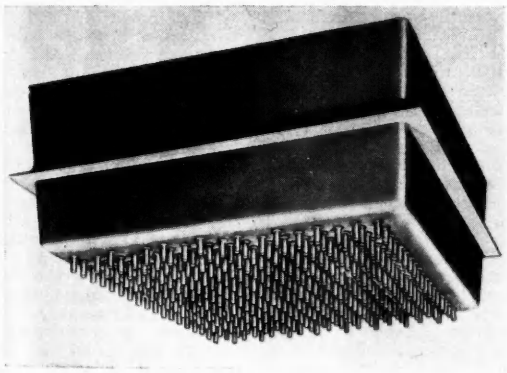


Fig. 1.—Plain studs welded on to bottom of fish-frying pan to increase effective heat conducting surface. This arrangement allows for the positioning of gas burners so that jets impinge on the studs and produce turbulence of hot gas throughout the bank of studs. Compared with a plain surface, the arrangement has reduced gas consumption by 24.2%.

The mechanical properties of the weld made with a Nelson gun are generally superior to those of any other means of fixing a stud to another member. Tests have proved that the strength of the weld is at least equal to that of the stud material. If the weld is made properly the stud always breaks first under a hammer test. A high quality weld is ensured by using the ceramic ferrule and the special studs supplied.

The ferrule excludes impurities from the atmosphere but has vents for the escape of the gas generated during welding, which is released in such a way that it blows out the dirt and scale on the molten metal. When welding conditions are correct, the ferrule so locates the molten metal around the stud that it appears as an almost symmetrical fillet. In practice, provided that the fillet is symmetrical it can be assumed that the junction of the stud and the metal is sound. The fillet of metal adds to the mechanical without reducing the strength below an adequate value.

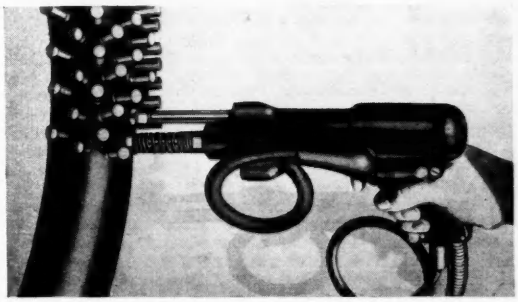


Fig. 2.—Welding plain studs on to a pipe. These studs increase the effective heat conducting or radiating surface. They can also be used to facilitate the application of lagging materials and to hold these securely around the pipe without bending.

Stud welding is applicable directly in the construction of steel structures in gas-works, stoking machines, conveyors, &c., and cooking and heating equipment. As, however, the gun is not limited to standard screwed stud it can be used for welding such items as pipe hangers, pins for securing heat insulations, saddles, and clips.

An interesting application of stud welding, which demonstrates the innovation in design that the technique may allow, is the welding of plain studs on to plates or pipes of heating equipment to increase their conducting or radiating surface. Fig 1 is an example of studs welded on the bottom of a gas-heated fish frying pan. The improved heat conductivity between the flame and the pan with this arrangement, as compared with a plain surface, resulted in a 24.2% saving in gas consumption. The principle of increasing thermal capacity by welding on studs is widely applicable and will form a basis for improvement in the design of heating equipment. Fig. 2 shows a Nelson gun welding studs on to a pipe—a procedure hardly practicable by any other means.

At a Lunchtime Ceremony at the works of the Perth Gas Department, on Jan. 21, Mr. Arthur M'Cabe, who is retiring after 42 years' service at the works, was presented with an armchair by Mr. W. Nicol Baird, Engineer and Manager. Mr. M'Cabe began work in 1906 when the old-type horizontal retorts were in use. He retires under the 65-year-old age limit.

COMMERCIAL AND INDUSTRIAL UTILIZATION OF GAS: NO. 5

By F. DICKINSON, M.Inst. F.,
Industrial Gas Engineer, Newcastle and Gateshead Gas Company

(*Continued from page 100*)

FERROUS AND NON-FERROUS PROCESSES

Manufacture and Characteristics of Cast Iron and Steel

AN approximate date for the termination of the bronze age and the commencement of the iron age may be set at 1,000 B.C. At that time iron was manufactured in Austria where there existed extensive forests—a source of charcoal—and a comparatively pure iron ore supply. Hitherto most of the domestic articles and weapons had been made of copper or alloys of copper because of the lower melting point (1,064°C.) than pure iron (1,505°C.). The inability to produce this higher temperature alone prevented the Celtic and Teutonic peoples from melting iron until they ascertained the solution to the problem, *i.e.*, pure ore—charcoal—good draught. The spread in the art of iron making from this central district was as follows:—

Westward—Germany, British Isles, France, Switzerland to France and Italy.
Southward—Greece, Crete, Egypt, Africa.
Eastward—Persia, Assyria, India.

The earliest type of furnace was sited on the top of a hill, and was generally a heap of stones with an opening in the direction of the prevailing wind. These furnaces only produced a few pounds of metal at a time and were entirely dependent on the state of the winds. The Egyptians produced a primitive type of bellows, and about the same time in Africa there came into use a bamboo cylinder and piston, the earliest form of blowing engine. This type of furnace is referred to as a "bloomery," a name held around Sheffield until the middle of the 19th century.

The product obtained from the reduction of ore in small quantities was either malleable iron or steel, which was in a pasty or solid form and had to be forged. Cast iron, where produced, was not understood and was scrapped as useless. With a demand for greater quantities of cheaper "steel," and the increase in the size of furnaces, the iron remained longer in contact with the fuel, absorbed more heat and carbon, and was tapped from the furnace as a fluid at 1,130°C. When the properties of the "new metal" became known, about 1450 A.D., the industry was established in Surrey, and was very flourishing in the Walloon district of East Belgium.

The above direct process for producing malleable iron, cast iron, and steel was one of reducing pure ore by means of charcoal. After the introduction of cast iron the indirect process arose in which ore was reduced to cast iron, and by the introduction of air blast, to malleable iron, giving an opportunity of removing impurities, and using a lower quality grade of ore. This was necessary as pure iron rarely exists in the free state in nature, being generally in combination with numerous other elements such as silicon, phosphorus, sulphur, manganese, &c. Combined, iron exists in relation to its oxides, *i.e.*, feric oxide—hematite (red), or magnetic oxide—magnetic (black). The Cumberland ore is a singularly pure hematite ore, while that from Newfoundland is a mixture of hematite and magnetic. The former is free from sulphur and phosphorus, neither of which is desirable in the finished product, whilst magnetic ores sometimes contain considerable quantities of these, which have to be removed. There are a number of ores obtainable from different districts in the world, of varying qualities, and they are classified into two arbitrary groups according to their sulphur-phosphorus content, mis-named acid and basic. Acid ores contain little or no sulphur and phosphorus, whilst basic ores have a high proportion of these elements.

It is obvious that iron-masters must be capable of producing uniformly first-class irons and steel from a diversity of ores of varying degrees of purity and size. Their aim then is to reduce them to a basic common denominator of analysis, and build them up to the required final analysis by the addition of carefully measured quantities of appropriate constituents. The first step is to prepare the ores for insertion into the blast furnace with such constituents. In the case of magnetites in their natural state, these are contaminated by the admixture of pyrites, iron phosphate, and other impurities which can be removed after crushing to a coarse powder—being non-magnetic—and the magnetic portion extracted by means of magnets. The ore is then calcined to repel water, CO_2, sulphur, and other matter volatile under the influence of heat and air. The process leaves the ore in a porous condition readily permeated and acted upon by the reducing gases of the blast furnace. Fine ores in the blast furnace cause irregular working, and immense quantities of flue-dust difficult to separate from the blast furnace gas. This is overcome by making these cohere by briquetting, nodulizing, or sintering. Briquetting is self-explanatory. Nodulizing is done by placing a layer of fine ore dust in a furnace where it is heated and rabbled until it becomes fused into small pieces or nodules, of about walnut size, which are covered with a glaze. In sintering, the fine ore dust is mixed with fine coal dust and placed in a furnace where it is heated until it becomes a pasty porous mixture which can be broken off in suitable lump size at the point of discharge. Being porous it is permeable to the blast furnace gases when being reduced to iron.

The charge put into a blast furnace consists of ore, fuel and flux, and the chemical changes only take place in the presence of an air blast. The fuel normally used in British practice is hard metallurgical coke, the flux required to remove as fusible slag the mechanically and chemically combined impurities is usually of a lime base, and the resultant products consist of slag, pig-iron, and blast furnace gas. The last mentioned is used for preheating the air prior to entry into the blast furnace tuyeres, in special gas engines for power generation, and for furnace heating. When mixed with coke oven gas it is also used for heating the Siemen's open-hearth steel furnaces. The slag can be crushed and mixed with tar for road material, or finely ground, mixed with lime, and heated in a kiln to produce an equivalent to Portland Cement. Dependent upon the mixture and treatment in the blast furnace the pig iron produced can be either hard white iron, (due to practically all the carbon being combined), or soft grey iron, (due to the carbon being mainly graphite), or grades of iron between these extremes.

The pig iron now becomes the common denominator for the preparation of cast irons, malleable or wrought iron, mild steel, and alloy steels. Cast iron is only suitable for work which has to withstand compression, and has not the properties of ductility, elasticity, nor tenacity. To obtain these qualities the pig iron has to be re-melted and puddled, to oxidise the metal and produce malleable or wrought irons, mainly for casting purposes. Puddled bars are tough, but having little carbon content cannot be made hard by heat treatment without the addition of carbon. This is done by the cementation or conversion process, the final product being a form of steel. Owing to the coarse crystals, weakened by blisters, it was found necessary to forge these cemented bars until the blisters were welded into an homogenous structure, forming Plated bars, which were then cut up, piled upon each other, covered with clay and borax to form a flux and prevent oxidation, and welded together. Such steel was called Shear steel, and by cutting the bars into two and repeating the process there was produced Double Shear steel. This converted steel was fairly homogenous and used for cutlery, but it is impossible to ensure perfectly even distribution of the various elements by such processes, particularly carbon, and this can only be done by melting the material, a slag of most of the impurities finding its way to the top by flotation, where it can be separated from the fluid steel. Under these conditions the carbon tends to become equally distributed throughout the fluid mass, and in 1740 converted bars were first melted in crucibles and cast, marking the introduction of the Crucible Process of steel making.

Huntsmen produced small quantities of steel by melting cemented bars in crucibles with hard coke, but the output was only sufficient for cutlery, cutting tools, and a few small machine parts. The demand for large quantities of steel, and large steel melting furnaces interested first Nasmyth, and then Henry Bessemer, the former using steam blown through a hollow rabbler, and the latter in 1855 patenting a process for purifying hot metal by blowing air through a pipe into the molten metal. The crucible was surrounded by a hot coke fire, but so violent was the reaction that sufficient heat could be maintained to keep the metal fluid without the coke fire. These experiments were mainly successful because Swedish iron (Acid), was used, and attempts with Basic irons were a failure. Even with Swedish irons the process would have been a failure had it not been for Mushet's invention of a de-oxidizing agent—Manganese, or as used in Bessemer practic—Spiegeleisen. The excessive temperatures were too much for the firebricks to withstand, and in the search for high temperature refractories the road sweepings of Sheffield were used successfully, revealing the original ganister material of that district, with which, in various forms, melting

furnaces for Acid steels have since been lined. Excess lime was introduced by Thomas in the Basic Bessemer process using a lining of dolomite, which on heating loses its CO_2 and is mixed with with anhydrous tar.

During the period of Bessemer's experiments Sir W. Siemens was investigating the preheating of producer gas for the regenerative system applied to glass tanks, and applied his experience in the design of the Siemens Openhearth steel melting furnace for the melting of cast iron, and wrought iron, (pig and scrap), in certain proportions on the hearth of a regenerative reverberatory type of furnace. The process was a slower one, conducted on a larger scale, but more under control than previous systems. It developed in two stages, firstly the pig and scrap method which was one of dilution with negligible reactions, secondly the pig and ore method in which the oxidation of the impurities in the ore was a primary importance. To-day there is no distinction; pig, scrap, and ore being used as circumstances demand.

Thus, by process of evolution we have arrived at the stage where steel is made by either the Bessemer, or the Siemens-Martin process, both of which are fundamental in relation to the types of ore available or used, the chief difference in construction of acid and basic worked furnaces being in the materials used for the hearth; in the acid process this is of ganister and in the basic process it is of dolomite or magnesite. The chief characteristic of the basic process is that it can deal with any iron, and can work large quantities of scrap, i.e., it is the most elastic process of steel manufacture.

We can now summarize the products derived from iron ores, and their characteristics, as follows:—

Cast Irons.

These cannot be hammered, drawn or rolled, but can be melted and cast into predetermined shapes of considerable variety of sections and weights, with limitations regarding minimum thicknesses of sections, owing to chilling difficulties when molten metal is being poured through narrow channels or spaces in moulds. White iron, with combined carbon, is used for hard castings, grey iron, with graphite carbon, for soft castings, and mottled irons for castings of intermediate degrees of hardness, as desired. Mottled irons are white irons which have partially decomposed during the cooling process, liberating graphite. This usually takes place at the point of slowest cooling, i.e., the lower centre of a casting, the appearance of a fracture indicating white iron speckled with grey.

Malleable or Wrought Irons.

These fall into the intermediate stage between cast irons and steel, and two main categories, white-heart and grey-heart, which are self-explanatory terms. They possess greater ductility than normal cast irons, are therefore applicable to wider specific uses, and can be either cast, wrought or forged according to analysis and requirements. Wrought iron is one of the purest of irons owing to extensive puddling and hammering, but is very soft, ductile, and relatively weak in this state. The nearest commercial pure irons are Swedish wrought iron, and "Armco" iron. Their virtues are the ability to withstand corrosion, the warning given before breakage by tearing tendency (hence the use for chains, couplings, and Admiralty cables), and ease of welding due to comparative purity. It was once thought that this immunity from corrosion was due to each crystal of iron being surrounded by slag. This is fallacious, the real reason is that little manganese is present in these irons.

Steels.

There are many varieties of steels made to appropriate analyses to meet specific requirements. Mild steels can be cast, forged, rolled or drawn within fairly wide limits according to process demands. As high percentages of carbon and other elements are added these limits become more circumscribed and critical. Carbon is added to give greater hardness, and a small percentage addition produces a marked effect. The inclusion of phosphorus increases brittleness, and sulphur content tends towards cracks in worked materials, both of which are undesirable, so that the reduction of these elements to negligible proportions is aimed at throughout the whole of the manufacturing process. On the other hand, the demand for very hard steels for high duty process appliances such as drills, reamers, cutting tools, dies, &c., or resistant metals such as armour plating, has created a wide range of alloy steels containing appropriate proportions of cobalt, chromium, tungsten, vanadium, manganese, and nickel, as found necessary for the specific applications of the finished articles. Some indication of the complexities of analyses of multi-element steels can be seen in the Howe's iron-carbon diagram which deals with variations due to carbon additions only. This reveals an interesting phenomenon; the change of crystal structure of a steel at definite temperature points relative to the amount of carbon addition, termed the allotropic or transformation range for the specific iron-carbon mixture. Thus, when a plain carbon steel is heated and cooled there are one or two important pauses or arrests in the rate of heating or cooling, the temperature and extent of the arrests depending on the carbon content and the rate of cooling, indicating that changes are taking place in the constitution of the steel. There are absorptions of heat on heating and evolutions of heat on cooling. The iron-carbon equilibrium diagram for any known condition is obtained by plotting the temperature of the arrest points against the carbon content of the steel and joining them, the lower critical point being termed A1 and the higher A3, whilst the ranges of temperatures between these points and the A1 and Acm points are known as thermal transformation ranges or critical ranges. The critical points on heating are known as Ac points (c = chauffage or heating), and those on cooling as Ar points (r = refroidissement or cooling); the latter being lower than corresponding Ac points, and is termed thermal hysteresis. The above deals with carbon additions only, and the addition of other alloys may profoundly modify the transformation ranges. From this, it will be seen that the heat treatment of high carbon alloy steels is a matter of complexity and importance, so that the hardening and tempering of such steels should only be done in strict accordance with the maker's instructions.

Normal Process and Heat Treatment

This is a very wide subject with which you will have contact in many industrial applications, and in great variety. Perhaps the best way to give a general picture would be to take the above metals in the order set out, and deal with the industrial processing which you are mostly likely to meet, indicating the applications for town gas.

The most economical unit for producing large quantities of cast iron is the cupola, as the fuel for melting the basic materials is itself the carbon element required in the iron. A cupola is essentially a vertical cylindrical steel tower lined with firebrick and ganister, with a charging platform at the top for insertion of measured quantities of hard coke, pig iron, scrap metal and/or hematite, and an air belt near the base through which air is forced through tuyeres into and upwards through the charge. The slag and molten metal collect in the hearth at the base of the cupola, and metal is run off, when at the correct analysis and temperature, at a tapping hole conveniently arranged at the bottom of the hearth, facing into the foundry. Once a fire has been started in the base of a cupola the hard metallurgical included coke, i.e., carbon, does all the melting. Gas torches can be used for drying out a relined cupola, and for initial lighting purposes. It can be used for the drying and heating of the ladles into which the molten metal is poured for carrying to moulds arranged on the foundry floor. These moulds are made of special sand mixtures to the final exterior shape of the desired castings. They are rarely solid masses of metal so that interior shapes have to be made in hardened sand, and placed in the moulds. The molten metal is poured into the annular space between the hardened sand core and the mould. Both cores and moulds have original moistures and volatiles in them which must be dried out, after which they must be carefully baked to give them sufficient strength for handling, and to withstand the weight of molten metal at the time of pouring. Smaller quantities of special irons, such as those with a high nickel content, can be melted in gasfired horizontal rotary furnaces. Here, the gas burner fires horizontally through the centre of the furnace, the flue gases being taken out at the other end, and, passing through a recuperator, heating the combustion air before being vented into a chimney. By this means the top portion of the charge and the upper brickwork is first heated, then the furnace is slowly rotated, turning the charge gradually over and exposing cooler portions to the primary heat, whilst the hot brickwork travels underneath giving secondary heating. By this means it is possible to evenly and rapidly melt the charge. This is a great improvement on earlier methods with static charges, where excessive furnace temperatures were maintained above the upper surface of the metal in endeavours to conduct sufficient heat through the mass to melt the whole of the metal, with disastrous results. When the castings are ready for machining they are sometimes annealed, particularly small castings with thin sections which have chilled rapidly in cooling, making them hard and brittle. Larger castings are not usually annealed unless this is called for, but it is good practice in principle as it relieves any molecular strains set up in the metal during processing operations.

Malleable iron castings can be produced from metal remelted in cupolas, but the modern tendency is to melt in large horizontal rotary units. One well-known plant is the "Sesci" powdered fuel rotary melter; similar units are available for fuel oil, and gas, the deciding factors being availability of fuel and working costs. Malleable castings must have very careful and prolonged annealing to give them the required grain structure and ductility. This has normally been done in beehive coalfired furnaces, but if economics permit there is no reason why gas should not be used for this purpose. The heating of wrought iron billets and bars for rolling and forging is a straightforward job for gasfired furnaces. Similarly with the annealing process.

The heating of slabs, billets, pairs and blanks of mild steel for primary rolling and drawing down is a simple gasfired furnace proposition, and again the final annealing. Drop stamping of blanks, rod end forging, heavy forging, upsetting, and other manipulating processes all call for quite normal gasfired appli-

cations. In all these operations there are set up granular or molecular strains which must be relieved by careful annealing. Shipyards and constructional engineering works manipulate primary sections and plates into final shapes as required, and stress-relieve where the ultimate usage demands such treatment, and this practice has now extended to fabricated pressure vessels. Most of these secondary operations are done in works sited within the areas of town gas supplies, giving a wide field of available applications from rivet heaters to large plate furnaces, and very large furnaces for stress-relieving, whether of steel castings or fabricated structures.

Reference has already been made to the recalescence points of special alloy steels, where other elments are added to give increased strength. It should be clearly understood that these elements are added at the expense of the iron and not the carbon content of the metal, so that by considerably slowing down the rate of cooling, and thereby impairing the ease of atomic moyement at the change points, there is given a self-hardening effect to the alloy. An ordinary carbon cutting tool loses its cutting power at about 300°C whereas most high speed alloy tool steels can retain this until at least 700°C. After manipulation and shaping of the articles they can be heated to 50°C above the upper critical temperatures without affecting their hardness, and to retain the benefit of the change in granular structure of the metal they are quenched in air, water, or oil as recommended by the makers. If left like this they would be brittle and liable to crack or break under stock or load, so that it is necessary to reheat them to a lower temperature and quench ; a process which has the tendency to reduce the brittleness faster than the hardness, and so give the total required conditions for satisfactory workshop operations. With low carbon steels there is a fairly wide temperature range within which tempering or drawing can be done without affecting the required and essential hardness factor, but with the complicated high duty alloys this range is shortened considerably by the reactions of the various constituents, so that the hardening and tempering temperatures and heat treatment cycles indicated by the makers are critical with very little tolerance, and must be rigidly adhered to. It is for this reason that the modern high speed tool furnace is equipped with first class burner equipment, temperature indication, and in certain cases with muffles and special gas atmosphere. In effect, it has clearly moved from normal furnace to machine tool practice.

It has been stressed in melting practice that the addition of carbon increases the hardness of irons and steels, but in a number of cases an all-through hardness would be most undesirable, i.e., where a hard surface is required to minimize wear with a soft core to withstand shock which would crack a hard core, as in hacksaw ends, pins, and gear wheels. To overcome this difficulty there are several methods, such as box-type case-hardening, salt bath hardening, and in specialized cases the Shorterizing process is used, but all these systems have one major object—the addition to and incorporation in the surface of an article of a coating of carbon. Once given this metallic addition the article can then be heat treated for hardness retention and tempering, although in many instances it is only necessary to grind the surface lightly to final dimensions, when it is ready for use.

Non-Ferrous Processes

As the above name signifies, the general run of commercial metals with no iron constituents are referred to. In general practice these are as follows : brass and bronze alloys, lead, lead alloys, bearing metals of the whitemetal variety, solders, etc., falling into two broad categories of hard and soft metals.

Dealing first with the hard metals, these are mostly alloys of copper and zinc with additions of tin, nickel, aluminium, phosphorous, lead and iron, as required for processing, and final use. The copper ores, mainly derived from Spain, although there are considerable deposits in Rhodesia, and other parts of the world, are crushed, sintered, calcined, and melted under precise oxidising conditions to 99.5% commercial purity, the zinc also being of similar purity. Dependent upon the quantities desired the appropriate proportions are charged into large horizontal rotary, medium semi-rotary, or crucible furnaces, melted and superheated to the correct pouring temperature, and cast into moulds of suitable shape for castings, or ingots, billets, and slabs. The latter are rough-machined for rolling into sheets or for extrusion into primary or final shapes. If the metal is not correctly mixed, poured into the mould in the correct manner and at the correct temperature and speed, then the ingot will not be sound, and imperfections both internal and superficial may persist throughout the subsequent operations, so that sheet, strip, wire or rod may be of poor surface finish and unsound interior at the final stages.

In rolling operations the reductions to which alloys are submitted, and the temperatures at which metals are annealed between rolling operations must be carefully scheduled down to the final critical anneal to bring them into a condition suitable for the requirements of the users.

In the extrusion of wire or rod the choice of alloys is limited to brasses containing 58% to 62% copper. Above this copper content, up to 68% the brasses are not plastic at high temperatures, but plasticity returns with a further increase of the copper content, and the alloys may again be extruded within limitations of purity of alloy and range of extruding temperature. For this work a cylindrical billet is cast and rough-machined, heated to a fairly high temperature suitable for the alloy, placed in a container and pushed by a hydraulic plunger through a die of such a shape as to produce the cross-section desired—round, square, or of more complicated design. The extruded shape, if of simple section, may be sized and stiffened by a drawing operation, or submitted to a series of drawing and annealing operations, e.g., for the production of small diameter wire. Extruded bars, rods, and sections are made chiefly of brass containing 58-62% copper with additions of other metals, to impart special properties to the alloys. When used for hot stamping 2-3% of lead is added to give free-turning quality. When high tensile properties are required, tin, manganese, or nickel is added up to 2-3%, and lead reduced to below 0.5%. In the making of wire the following metals are used, H.C. copper, commercial copper, phosphor bronze, gilding metal, cupro-nickel, nickel silver, various brass alloys, and zinc.

When cold-worked all non-ferrous metals such as the above, with the exception of tin and lead, harden. As the hardness increases with the amount of cold work a point is reached where further work would lead to cracking or failure of a metal, so that annealing must be done before this critical stage has been reached. Material is delivered to the user in a state of medium softness, having high ductility and considerable strength, and being capable of being worked to a great degree with a fine smooth finish. If annealed to maximum softness it would have high ductility, low strength, and work with a rough surface finish. It is thus shown that both inter-stage, and final annealing must be done with great care in relation to the particular type of alloy employed. This also refers to blanking and cupping operations in press work, and to the finished pressing which is frequently left in a hard condition, as being suitable for its commercial use, and burnished. If, however, the pressing is of brass it is liable to crack spontaneously, or "season crack," which can be overcome by low temperature annealing.

A list of some commercial metals or alloys is given below, as follows :—

H.C. (electrolytic) copper	99.9% Cu.	For electrical work
Commercial copper	99.5% Cu.	For general purposes
Cap copper	97% Cu., 3% Zn.	For deep drawing and stamping
Cartridge brass	70% Cu., 30% Zn.	For general drawn work, requiring strength and ductility
Stamping brass	65% Cu., 35% Zn.	For press work
Yellow metal	60% Cu., 40% Zn.	For sheets, &c., having little deformation in cold working
Phosphor bronze	95.5% Cu., 4% Sn., 0.5% P.	For articles requiring a hard or spring temper
Aluminium bronze	91% Cu., 9% Al.	For coins and resistance to oxidation at high temperatures
Cupro-nickels	75-95% Cu., 25-5% Ni.	For electrical work, and other purposes requiring strength and ductility
Nickel silver	50-70% Cu., 10-35% Zn., 7-30% Ni.	For colour, resistance to corrosion and electrical resistance purposes
Gun metal	90% Cu., 10.10% Sn.	For castings and general purposes
Bearing metal	80% Cu., 10% Zn., 10% Sn.	For bearings
Monel metal	28% Cu., 67% Ni., 5% Fe. plus Mn.	For greater tensile strength

From the above it will be seen that gas can be used for all melting and annealing purposes in a variety of standard furnaces.

Some useful general consumption figures for overall average working day practice are given below, as follows :—

5-6 cu.ft./lb. for small crucible melting (50-100 lb.)
4-5 cu.ft./lb. for medium crucible melting (150-250 lb.)
3.5-4 cu.ft./lb. for large crucible melting (300-600 lb.)
2.5-3 cu.ft./lb. for large furnace melting (1,000 lb. and over)

The above refers to melting temperatures generally in the 900°-1,100° C. range ; for hard alloys with higher melting and pouring temperatures the consumptions will obviously be proportionately greater, and conversely for softer metals.

In the soft metals we have already dealt with lead, and lead alloys such as used in the printing trade. The solders range between 50/63% Pb.-50/37% Sn. for plumbers' work, with bismuth solder of 40% Pb., 20% Sn. and 40% Bi. mixture. These have low melting points, respectively 414°/468°F, and 232°F, so can easily be melted in small pots with natural draught ring burners, or the like. The whitemetals used for bearings vary slightly in composition. When of a lead base their constituents are 75% Pb., 15% Sb., 10% Sn. and when of a tin base 83.3% Sn., 8.4% Sb. and 8.3% Cu. With the low melting temperature of 460°F these are easily dealt with in small pot type furnaces using natural draught ring burners.

The soft metal nearest to the brasses and bronzes for processing is aluminium which can be cast, rolled, wrought, forged, extruded and drawn, calling for appropriate billet heating and annealing furnaces. The softness, ductility, lightness and adaptability of this material to many commercial requirements opened up a field beyond the scope of the harder and heavier metals which was almost without competition prior to the advent of plastic articles, and an extensive die-casting trade was centred in the Birmingham district. The metal is usually melted in bulk in 400 lb. rotary or semi-rotary furnaces and then carried to a

number of small maintaining pots, usually of about 1 cwt. capacity, where it is maintained at 700°C. for ladling into moulds set up adjacent to the pots where die-castings are made at almost mass production rates. Normal melting takes 3-4 cu.ft. gas per lb. reduced to about 2 cu.ft./lb. for continuous melting over an 8 hour day, whilst maintaining in the individual pots takes 3-4 cu.ft./lb.

A very important development of straight aluminium is "Duralumin" (95% Al., 4% Cu., 0.5% Mg., and 0.5% Mn.) and similar alloys which were first produced some thirty years ago when a demand arose for substitutes for steel in light fabrication work, with all the requisites of strength, rigidity and tensile and ductile qualities, but with greater lightness. This was essential for aeroplane manufacture, and the scope has been extended to include rivets, automobile pistons, and a wide variety of other articles. Some aluminium alloys can be strengthened by one of two methods of heat treatment, i.e., those given a high temperature treatment followed by quenching (solution treatment), after which their strength increase spontaneously and without further heating, and those which require high temperature solution treatment and low temperature precipitation-treatment for the development of full strength. Temperatures for solution treatment range from 450°-540°C, depending upon the alloy and the form of the material, and for precipitation treatment from 100°-200°C. It will thus be seen that temperature ranges are narrow, critical temperatures vary with the alloy compositions, and duration of heat treatment is in relation to the form of material being treated. All this calls for selective furnaces, and accurate control of heat input and furnace temperatures, a very fine field for the use of town gas. The usual furnaces employed are salt baths and forced air re-circulation units, the choice depending upon considerations of variety, and size of work, mixed loading, etc. Generally speaking, both types give evenness of heating, but liquid baths transmit heat to the articles more quickly, take heavy and light sections together without uneven heating, and support thin sheets without the distortion which could arise in forced air units. The latter are generally more used for the solution treatment of finished parts.

Chemical Symbols Used.

Aluminium	...	Al.	Magnesium	...	Mg.
Antimony	...	Sb.	Manganese	...	Mn.
Bismuth	...	Bi.	Molybdenum	...	Mo.
Carbon	...	C.	Nickel	...	Ni.
Cobalt	...	Co.	Phosphorus	...	P.
Copper	...	Cu.	Sulphur	...	S.
Iron	...	Fe.	Tin	...	Sn.
Lead	...	Pb.	Tungsten	...	W.
Zinc	...	Zn.			

Protective Atmospheres.

It has been shown that after the processing of all metals it is necessary to final anneal the articles, but in many instances it is essential to have a high polish on them to resist oxidation when in service, and enhance their value from both a sales and utilization angle. In many cases this high finish is achieved during final processes, but is dulled by either the annealing itself or post-anneal quenching. It can often be revived by pickling in dilute acid washes, but this is an additional cost which could be avoided if the bright finish could be maintained during the annealing process. The trouble is usually due to oxidation at elevated temperature, but with ferrous articles there may be decarburization, carburization, or a desire for controlled carburization. It has been found that by the use of appropriate prepared furnace atmospheres these reactions can be controlled to a degree sufficient to give the desired results.

Types of Atmospheres

A "controlled atmosphere" is one that is produced as a separate entity from special equipment designed to make a gas or mixture of gases of a pre-determined composition. A number of generally used atmosphere gases are given below, as follows:

1. *Completely burned gas.*
   This usually refers to town gas which is maintained at a reasonably close analysis within a specific area of supply, and is obviously the cheapest form of atmosphere gas where it is the products of combustion primarily used for the heating of a furnace, then withdrawn before dilution with shop air, passed through a water cooled condenser where the bulk of the water vapour is precipitated at a temperature below dew-point, through a silica-gel bed, and finally into the muffle of the furnace. This is an ideal arrangement so long as the volume of products is maintained, but where automatic furnace controls are used the low gas rate setting may reduce the volume to a point where the flow is insufficient for practical continuity of flow to maintain a pressure in the muffle. It is then desirable to have a separate combustion chamber for the atmosphere gas to ensure steady flow conditions. Even so, it is still a low-priced atmosphere gas.
   For many years attempts have been made to use this gas for carburizing purposes with only partial success, and inconsistent results. An improvement is to use it as a carrier gas, and superimpose a secondary atmosphere gas upon it during the carburizing temperature period only, usually from a methane or butane source. Where it has been used to prevent oxidation only it has been very successful. A similar type of atmosphere gas could be produced from most other fuel gases with allowances made for differences in the flue gas analyses, but town gas appears to be more consistent and more readily available. This atmosphere gas is inert, and non-explosive.
2. *Completely burned gas with CO_2 and H_2O removed.*
   This is much as above, but the gas is burned to almost complete combustion as a reducing mixture. Additional plant is incorporated to extract the CO_2. It is inert, and has a high nitrogen content.
3. *Partially burned gas.*
   This atmosphere is the same as No. 1, but the combustion chamber has to be initially heated to ensure sufficient temperature being available to maintain combustion when the air is reduced to produce CO and H_2 in the flue gases. It calls for prevention of air leaks at the muffle as it is a combustible mixture, and care must be taken when using it as the heavy CO content is toxic.
4. *Partially reacted or cracked gas.*
   This requires external heat for processing, and is a combustible gas.
5. *Fully reacted gas.*
   This is produced from the complete reaction of gas with the proper amount of air to produce only CO, H_2 and N_2.
6. *Dissociated Ammonia.*
   This is produced by the cracking of anhydrous ammonia, which gives a gas very high in hydrogen with a very low dew-point, i.e., about 75% hydrogen, 25% nitrogen, and dew-point of —60°F.
7. *Partially burned dissociated Ammonia.*
   As above, but with a limited amount of air to produce 20% H_2, 80% N_2, and no O_2, but dew-point about room temperature. This is cheaper to make and sufficient for a number of applications.
8. *Completely burned dissociated Ammonia.*
   This gas is produced by the complete combustion of a mixture of air and dissociated ammonia, with a slight deficiency of air so that no oxygen results from the combustion process. It consists of a very pure mixture of 99% N_2, and 1% H_2, with dew-point at room temperature so that further drying must be used if the application requires this.

In many applications it is necessary to dry the gas to lower dew-points than those obtained from equipment cooled with normal cold water. Dew-points of 40°F can be obtained by the use of refrigerating units and for lower dew-points an activated alumina dryer must be used. This will dry gases to dew-points below −60°F if necessary.

Applications: Annealing

Non-Ferrous Metals.

Copper may be annealed without oxidation in a steam atmosphere, but is liable to water staining which is undesirable. Bright surfaces can be obtained by using No. 1 atmosphere, slightly reducing. At higher temperatures copper is discoloured by even minute quantities of sulphur compounds, particularly hydrogen sulphide, which requires elimination of even 5 grains per 100 cubic feet in town gas. Combustion will convert both organic and inorganic sulphur into sulphur dioxide which is carried off in condensate, and hydrogen sulphide can be removed by passing through iron oxide. Some copper contains a little oxygen which can react with hydrogen in a controlled atmosphere and cause embrittlement. To overcome this a minimum of H_2 and CO, say 0.5-0.75% must be used without any free oxygen.

Copper-Nickel Alloys may be bright annealed with No. 1 atmosphere, free of sulphur, with higher H_2 and CO as hydrogen embrittlement is not a problem.

Copper-Zinc Alloys (*Brasses*) may be clean annealed with No. 1 atmosphere. Bright annealing is not obtained due to volatilization of zinc from the surface of the material at higher temperatures with oxidation of the metal due to the CO_2 and H_2O content of the controlled atmosphere which can be greatly retarded by a high nitrogen atmosphere—No. 2.

Copper-Silicon Alloys can be bright annealed with high nitrogen atmosphere free from CO_2 and H_2O (No. 2) and entirely free from traces of sulphur.

Copper-Silver Alloys can be bright annealed with atmospheres Nos. 1 and 3, entirely free from traces of sulphur.

Nickel and Monel Metal can be bright annealed with atmospheres Nos. 1 and 3, but although free of oxide may have a "matt" surface, a really bright finish can be obtained by using No. 6, 7 or 8. "Inconel," which is a high nickel content bearing alloy with chromium and iron, can only be bright annealed in Nos. 6, 7 and 8.

Aluminium and alloys can be successfully treated in air atmospheres of low moisture content, or Nos. 1 and 3. Special atmospheres are not so essential as with copper/nickel alloys.

Magnesium can be annealed in No. 1 atmosphere which prevents active oxidation and possible combustion of the magnesium at normal heat-treating temperatures. Air atmospheres with 0.5-1.0% sulphur dioxide are also used successfully.

Ferrous Metals

Low Carbon Steel can be bright annealed with No. 3, prepared for a maximum reducing atmosphere. Where available cooling water is over 60°F the dew-point of the atmosphere gas leaving the generator will be over 70°F. In this event atmosphere No. 3 can cause discoloration of steel due to the oxidizing action of excess water vapour as the steel slowly cools down through a temperature range from 1,100°F to 700°F. This atmosphere is approximately in equilibrium with low carbon steels at normal annealing temperatures so that there is no appreciable carbon gain or loss. It is definitely decarburizing to medium, high carbon, and alloy steels.

Medium and High Carbon Steels can be bright annealed in No. 2 which is not decarburizing and practically neutral hence suitable for long-cycle annealing of high carbon and alloy steels.

Alloy Carbon Steels (*Tool Steels and High Speed Steels*) can be annealed in No. 2 as above.

Stainless Steels, including chrome nickel iron and chrome iron alloys can be annealed without heavy oxidation in Nos. 1 and 3, and with very little oxidation in Nos. 2, 4, 5 and 3 (with CO_2 and H_2O removed), which we will term 3a. For bright annealing it is necessary to employ an atmosphere of pure dry hydrogen and there must be no trace of oxygen from any source, either atmosphere gas or by infiltration, so that a specially made tightly sealed muffle must be used. No. 6 is most suitable and Nos. 7 and 8 can be used by absolute extraction of oxygen and water vapour.

Hardening of Ferrous Materials. Finished machined parts can be hardened without either oxidation or decarburization in suitable atmospheres, so saving the added process cost of redundant further machining, grinding, sand-blasting, or pickling. To bright harden without decarburizing, the CO_2 and water vapour content must be low, i.e., Nos. 2 and 3a, also No. 5. No. 4 is suitable for hardening medium carbon steels at 1,400-1,450°F for periods below two hours, and No. 5 for high carbon and alloy carbon steels as, having no CO and only a trace of water vapour, it is non-decarburizing. It can also be set in balance so that neither carburizing nor the reverse takes place. This also holds for tool steels and high speed steels. The high-carbon/high-chromium tool steels can be hardened without decarburization but will tarnish owing to oxidation of the chromium, and to bright-harden them it is necessary to use No. 6 atmosphere in a specially designed alloy muffle furnace.

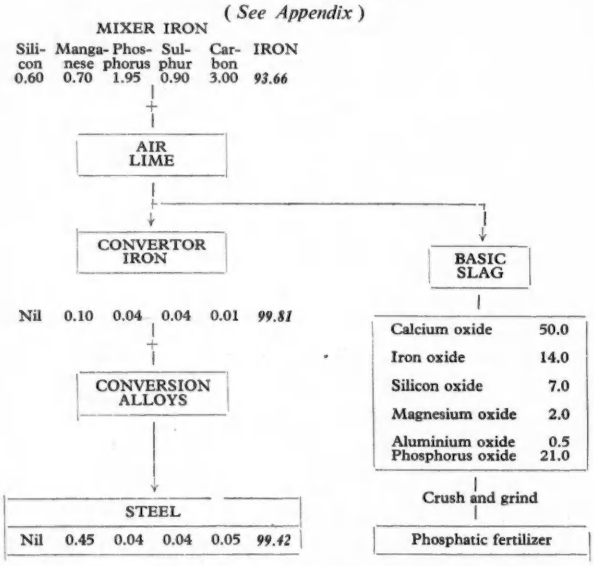
Gas Carburizing. As already mentioned, this can be done by having a "carrier" gas free from CO_2 and H_2O vapour, and adding measured quantities of methane for the addition of carbon to the surface of the articles during the period when they are soaking at the correct temperature. No. 5 gas is a suitable carrier gas, but every care must be taken to eliminate oxygen and ensure soot-free carburizing.

Atmosphere Furnace Brazing. Copper and copper alloys can be brazed in No. 1, but sulphur must be removed if discoloration has to be avoided. Reducing atmospheres such as Nos. 3, 4 and 5 can also be used, but incline towards hydrogen embrittlement. Silver brazing of steels at 1,700°-1,800°F, and copper brazing of steels at 2,050°F can also be done in reducing atmospheres such as No. 3 for low carbon steels, but where decarburization must be prevented as in medium and high carbon steels then Nos. 3a or 5 are preferable. For stainless and high chromium steels a highly reducing atmosphere such as No. 6 is necessary, as well as dry, oxygen-free hydrogen.

Sintering or Powder Metallurgy. Controlled atmospheres are necessary in the production of metals and alloys for this new application. Brasses and bronzes require reducing atmospheres such as Nos. 3, 4 and 5, also general ferrous alloys and iron; the other carbon steels following normal ferrous metallurgy.

BESSEMER PROCESS.

(*See Appendix*)



Protective Coatings

The necessity for protection of finished parts against surface oxidation is felt in practically every walk of life from the painting of woodwork to the interiors of metal bodies, and some indication is given below of a few engineering applications.

In the motor and certain other industries a combination of protection, colour, and high finish is desired. This is met by the use of appropriate paints, enamels, lacquers, and cellulose coatings, which in general are baked on after suitable primary or ground coats have been used. These coverings would be too delicate and expensive for the rough usage to which many articles are exposed, and a universal covering for a wide range of ferrous goods is a zinc coating, i.e., they are galvanized after fabrication. Other appropriate coverings for certain ferrous articles comprise tinning, terning, lead coating, and vitreous enamelling. Non-ferrous parts requiring protection can be coated by tinning, or lacquering, and where a hard high finish is essential by being copper plated, nickel plated and/or chromium plated by deposition in baths containing suitable acids reacted by electric currents, leaving a coating of predetermined thickness upon the surface of the articles.

Another anti-oxidation method for ferrous articles is to react the surface with oxygen to saturation point, producing a di-oxide or tri-oxide surface film immune from further oxygen reaction in normal usage. For example, the water surfaces of C.I. sectional boilers can be bower-barffed by exposure to a temperature of about 800°C in an atmosphere of superheated steam. Anodizing or electrolysis was originally used for small parts by making them the anode in an electrolytic cell containing chromic or sulphuric acid. This has mainly been superseded by immersion in liquids causing chemical reactions, such as bonderizing and parkerizing. There are numerous other proprietary methods and in most of them there is a clear field for gas. The process is one of several stages, from the initial preparation to ensure absolutely clean surfaces, to the final hardening-on, where necessary, and ranges from the "blueing" of tacks to the complicated coating of Sten gun parts, which is as follows:—Finished parts are placed in a tri-chlor-ethylene degreasing bath, then in a tank of boiling water to remove any traces of the above, into a caustic soda solution followed by washing in water, into a chemical solution to produce a primary coating, dipped into a further chemical solution to give a final coating, stoved at 600°F, and finally washed. The resultant finish is impervious to attack from atmosphere, salt water, or other normal oxidizing agents.

Bibliography

Acknowledgments to sources of information :

"Terms and Definitions Relating to Heat Treatment of Steel," British Standard 1392 : 1947.
"Non-ferrous Metals and Alloys," Nobel Industries, Ltd.
"Prepared Atmospheres," C. E. Peck (A.G.A.).
"Bessemer Process," Stewarts & Lloyds, Ltd., Corby.

Books for further study :

Standard text-books on ferrous and non-ferrous practice.
"Steel and its Treatment," D. K. Bullins.
"Metallurgical Calculations," Richards.

Appendix to Article No. 5

BESSEMER PROCESS.

Before 1856 only wrought iron (very often containing inclusions of slag), and cast (or pig) iron were known.

1856. Henry Bessemer removed the impurities by blowing AIR through molten pig-iron BUT left many air pockets (blow holes) so ADDED spiegeleisen which removed the blow holes but also added CARBON and produced STEEL. The process would only work with pig iron obtained from high grade haematite ore.

1877. Thomas and Gilchrist changed the lining of the Converter from silica brick (acidic) to dolomite (alkaline or basic),

added lime, and so paved the way to the conversion of iron from the Northamptonshire and other ironstone beds into BASIC BESSEMER STEEL.

TYPICAL LARGE SCALE PRACTICE

Iron in : 60 ton capacity lidded ladles.

Slag.—Raise ladle to mixer platform level, rake off slag (18% sodium sulphide) with iron bar with wooden block.

Into mixer :
(Mixers three).—1,000 tons capacity, coke oven gas fired.
Sheet shell, 1 in.
Asbestos lining, 2 in.
Firebrick lining, 12 in.
Mangesite lining, 16 in.
Function.—(1) Maintain metal at 1,250° C. (2) Neutralize variations from tap to tap.
The manganese slag is only removed when mixer is emptied.

Out of mixer : Into transfer ladle containing soda ash and weighed to 25 tons. Slag.—Sulphur down to 0.09%.

To convertor : 5 units. 20 ft. high, maximum width 13 ft. Dolomite (basic) lined. Loss in weight due to (*a*) removal of impurities ; (*b*) oxidation of iron.

Sequence.—
(1) Add lime—6,500 lb. Blast 2-3 lb. sq. in.
(2) Add hot metal.
(3) Add scrap.
(4) Pressure raised to 28 lb. sq. in.
(*a*) Pink flame—Si. removed.
(*b*) Brilliant yellow—C. removed.
(*c*) Dense red—P. removed plus ferric oxide.
(5) Sample—determines length of—
(6) Afterblow.
(7) Add spiegel (74% Fe., 6% C., 20% Mn.) and ferro-manganese (80% Mn., 14% Fe., 6% C.).
(8) Slag (basic—fertilizer).
(9) Form line dam at mouth.
(10) Pour into teeming ladle (25 ton capacity).

Teeming : Through plughole at bottom of ladle.

Moulds.—Narrow and upwards, 2½, 3½ or 4½ tons capacity ; lid, to exclude oxygen and prevent boiling.

Steel out : First to soaking pits then rolling mills by rail.

CHROMIUM-MOLYBDENUM STEEL CASTINGS

The British Standards Institution has recently published B.S. 1461-63 for chromium-molybdenum steel castings. This standard includes three specifications for steel castings for general engineering purposes in which the castings will normally be operating at temperatures in excess of 400° C.

For each specification the chemical composition of the steel is specified and the recommended heat treatment procedure is given in an appendix. Test requirements relate to the tensile and bend test, and provision is made for non-destructive tests, for hardness test after heat treatment, and for hydraulic testing where appropriate. Details are included of process of manufacture, fettling and dressing, freedom from defects, testing facilities, branding and repairs to castings. A second appendix gives recommendations with regard to welding procedure.

Copies of this standard can be obtained from the British Standards Institution, Sales Department, 24, Victoria Street, London, S.W.1, at a cost of $2, post free.

SCOTTISH BUILDING CENTRE

At the 11th Annual General Meeting of the Scottish Building Centre, held in Glasgow on Jan. 21, 1949, the Chairman, Colonel G. Gardner-McLean, referred to the satisfactory progress made during the past year. The number of enquiries had increased by over 60% to 6,500, while visitors to the centre showed an increase of approximately 100% at 26,000. Many visitors from a very wide field, including a considerable number from overseas, had visited the Centre. He registered satisfaction that the Centre was now definitely established as a vital link and pivot of the building industry in Scotland, and felt that it was a source of great satisfaction that the services provided free of charge by the Centre were being fully utilized and appreciated not only by Government Departments, architects, surveyors and builders, but also by the general public.

The Chairman was also pleased to say that not only was the Building Centre able to maintain the numbers of temporary exhibitions and displays which had proved so successful during the past year, but was now in a position materially to extend these. It was clear from this that the Centre's activities, and its influence on the building trade, had greatly increased.

Many of the exhibits in the Building Centre had been redesigned ; new and available materials were replacing those which had been unobtainable for some time. The Centre, said Colonel Gardner-McLean, was more representative to-day in its variety of exhibits than at any time

Contacts had been established with the various educational authorities, and in consequence, many educational institutions connected with the building industry were now holding their regular lectures and meetings in the Centre.

GAS SUPPLY IN SOUTH WALES

One of the recommendations of Mr. W. Hodkinson following his investigation of the gas shortage in the Western Valley of Monmouthshire was that some of the ovens at Blaenavon should be used for cracking oil into gas, a process which could be put into operation in about three weeks.

This was revealed at a Press Conference at the Ministry of Fuel and Power headquarters in Cardiff on Thursday when a statement was made by Mr. F. W. Smith, Deputy Secretary to the Ministry, who was accompanied by Mr. T. Mervyn Jones (Chairman, Wales Gas Board) and Mr. J. W. Davies (Senior Officer of the Ministry in Cardiff).

Reporting on the progress of the new gas-works at Panteg, near Pontypool, Mr. Smith said that in the absence of any contingencies it was hoped the plant would be completed at the beginning of April and that gas would be available for the public by July. Practically 99.9% of materials required were on the site and special efforts were being made to speed up delivery of the remaining requirements. The overall problem was to meet the gas deficiency between now and next July. The Blaenavon Steel Works were the oldest in the country and owing to old age certain of their coke ovens had collapsed since last December and an output of 1.8 mill. cu.ft. per day had been severely curtailed. On one day no gas at all was available for outside consumption. The present output was 700,000 cu.ft. and it was hoped to increase this to 800,000 cu.ft. by the end of the week.

The Wales Gas Board had arranged for two of its technical staff familiar with oil cracking processes to supervise the installation of the necessary gear. Mr. Hodkinson had also recommended that propane gas made by I.C.I. should be brought down to boost the heat into retorts to increase gas supplies. These proposals had been approved and would go ahead. It was estimated that at the end of three weeks output at Blaenavon would reach 1.6 mill. cu.ft. a day, which was the output before the recent breakdown. Work, it was explained, had started which would enable 50,000 cu.ft. of gas to be supplied daily by the Newport Gas Company and this would be finished in a day or two.

Mr. Hodkinson had also suggested that the Abertillery Gas Company, which was already supplying 70,000 cu.ft. per day to Blaina and Brynmawr might increase its present output of 700,000 cu.ft. by 150,000 cu.ft. by using Yorkshire coal. This, however, cost £1 a ton more than Welsh coal. He, Mr. Smith, desired to acknowledge the co-operation of the Abertillery authority who were prepared to undertake this change, although it would mean putting in a certain amount of ancilliary plant. Conversations were now in progress between the Company and the local authorities concerned. If this arrangement was put into operation it might be necessary to raise gas charges in the area.

Another proposal was the laying out of a half mile of mains from Mynyddislwyn to Abercarn to provide an extra 30,000 cu.ft. This suggestion was now being discussed.

If these recommendations were carried out they would provide approximately 230,000 cu.ft. of gas per day which could be maintained indefinitely so long as the supply from Blaenavon was adequate to meet all needs.

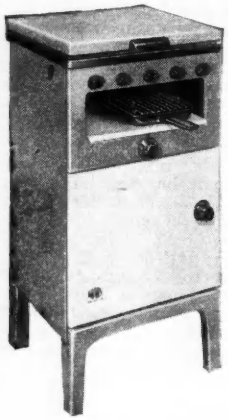
Arrangements had also been made, said Mr. Smith, to bring in carburetted water gas plants from Mitcham and Epsom. These were now being dismantled by a firm of contractors and a search was being made for a suitable site for them. There was, however, no guarantee that these plants could be put into operation sufficiently soon to deal with the present emergency, but in any case they could be used elsewhere.

Dealing with measures taken to alleviate "a rather desperate situation in some districts," Mr. Smith went on to say that the Chairman of the South Wales Electricity Board had agreed as a priority undertaking to install electric lighting in about 1,000 houses in the Abercarn district. Arrangements had also been made for communal feeding in conjunction with the local authority, and for the supply of paraffin cooking stoves to householders. Forty of these double burner stoves were arriving at Abercarn that day. A thousand were available, if necessary, and their distribution was in the hands of the Women's Voluntary Services.

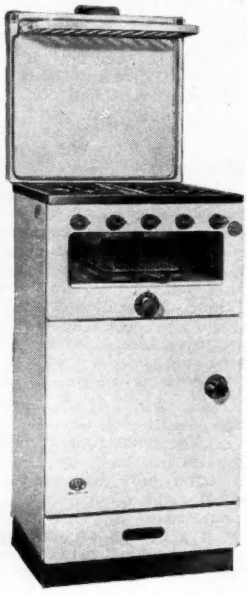
Mr. Mervyn Jones stated that the minimum consumption in the area was 3 mill. cu.ft. per day. Existing works at Pontypool were supplying 1.6 mill. cu.ft., leaving a deficiency of 1.4 mill. cu.ft., which formerly was supplied by Blaenavon. The Blaenavon works at the moment were only producing 700,000 cu.ft. per day. The gap, it was hoped, would be met by the recommendations which were now being put into effect. The next three weeks would be the most difficult period, after which it was hoped that the situation would become progressively easier. When the Panteg works were in production the output would be 4 mill. cu.ft. per day.

Mr. Jones added that of 72 ovens in the area, 21 were now beyond repair.

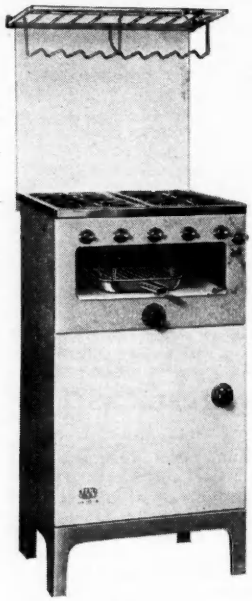
choice is one of the main features



177 with hinged cover closed; 3 boiling burner hotplate; 14" oven; cast iron legs; dapple/white finish.



177 with hinged cover and shelf; 4 boiling burner hotplate; 16" oven; plinth base; cream/black finish.



177 with platerack and backplate; 4 boiling burner hotplate; 16" oven; cast iron legs; dapple/white finish.

177 with short splashplate; 3 boiling burner hotplate; 16" oven; tubular legs; cream finish.

MAIN 177

GAS COOKER

WITH A CHOICE OF INTERCHANGEABLE FEATURES

GAS STOCKS AND SHARES

Stock markets remained quiet throughout the week, the total markings for the period ended Thursday evening being 33,764, compared with 60,812 for the corresponding week of 1948. Gilt-edged securities, after a slight fall early in the week, recovered the previous week's average of 113.76, against 112.88 a year ago. Industrial shares lost 0.1 point on the week, finishing at 122.6, compared with 125.9 at the end of January last year.

Dealings in gas stocks totalled 202, showing only a slight increase on the previous week. In the corresponding week last year—the week in which the Gas Bill made its first appearance—the total was 480. The official announcement of the fixing of May 1 as vesting date for the nationalization of the gas industry was too late to affect the period under review. Within the last few days the proprietors of many gas undertakings have appointed stockholders' representatives, charged with safeguarding the interests of stockholders in negotiations as to security values. The British Gas Council is setting up a stockholders' representatives' committee to deal with matters of mutual interest.

The week's price changes in gas stocks were as follows :

OFFICIAL LIST

Brighton, &c., 5 p.c. std. cons.	104 —109	+	1
Do. 6 p.c. std. cons.	113 —118	+	1
Commercial, ord.	92 — 97	+	1
South Metropolitan, ord.	103 —108	+	1

Quotations on the London Stock Exchange

When last ex-Dividend	Dividends Interest. Total for Year %	NAME.	Quotations Jan. 27
Sept. 15	4	Alliance & Dublin Cons. Ord.	21/6—23/6
Nov. 3	5	Asscd. Gas & Water U'd'tgs Ord.	22/ —23/
"	6	Do. Deferred	22/9—23/9
Sept. 1	4½	Do. 4½ p.c. Red. Cum. Pref.	20/ —21/
"	4	Do. 4 p.c. Red. Cum. Pref.	19/ —20/
"	4	Do. 4 p.c. Irred. Cum. Pref.	18/3—19/3
Aug. 18	7	Barnet Ord. 7 p.c. max.	153—158
Aug. 16	5	Bath Cons. Ord. 5 p.c. basic	104—109
Sept. 17	6½	Bombay, Ltd., Stock	35/- -40/-
Aug. 18	8½	Bournemouth Std. 5 p.c. sliding scale	163—168
"	7	Do. 7 p.c. max. div.	153—158
"	4	Do. 4 p.c. Pref.	96—101
"	6	Do. 6 p.c. Pref.	124—129
"	3½	Do. 3½ p.c. Red. Deb.	95—100
Dec. 15	4	Do. Perp. 4 p.c. Deb.	96—101
Aug. 18	5·35	Brighton, &c., 5 p.c. Std. Cons.	104—109
"	6·3	Do. 6 p.c. Std. Cons.	113—118
Dec. 15	5	Do. 5 p.c. Perp. Deb.	118—123
Aug. 4	5	Bristol, Gen. Cap. 5 p.c. max.	112—117
Dec. 15	4	Do. 4 p.c. New Deb. Red.	94— 99
Sept. 29	7½	Brit. Gas Light Ord.	127—132
Jan. 5	5½	Do. 5½ p.c. 'B' Cum. Pref.	108—113
Dec. 15	4	Do. 4 p.c. Red. Deb.	93— 98
Aug. 4	10	Cambridge U. & T. Orig. 10 p.c. Cons.	190—200
"	5	Do. 5 p.c. Cons. 'C'	95—100
"	7	Do. 7 p.c. Cons. 'B'	135—140
Nov. 3	4½	Cape Town, Ltd., 4½ p.c. Cu. Pf.	17/ —19/
Oct. 13	6½	Cardiff Con. Ord.	118—123
Mar. 10	5	Cheltenham, 5 p.c. basic Cons. Ord.	102—107
Dec. 15	4	Do. 4 p.c. Perp. Deb.	94— 99
Aug. 4	5¾	Chester United Ord.	107—112
Nov. 3	7	Colombo Ltd., Ord.	27/ —32/
"	7	Do. 7 p.c. Pref.	22/ —24/
Sept. 29	5	Colonial Gas Assn. Ltd. Ord.	16/ —18/
"	8	Do. 8 p.c. Pref.	24/6—26/6
Aug. 4	5	Commercial Ord.	92— 97
Dec. 1	3	Do. 3 p.c. Deb. Perp.	72— 77
Aug. 18	5	Do. 5 p.c. Irred. Deb.	107—112
"	6	Croydon sliding scale	120—125
"	5	Do. max. div.	102—107
"	4	Do. 4 p.c. Irred. Pref.	95—100
Dec. 15	4	Do. 4 p.c. Perp. Deb.	94— 99
"	5	Do. 5 p.c. Perp. Deb.	119—124
Aug. 18	8	Derby Cons. Ord.	135—140
Dec. 15	4	Do. 4 p.c. Red. Deb.	92— 97
Aug. 4	5	East Hull Ord.	93— 98
Aug. 18	5	East Surrey 'B,' 5 p.c.	98—103
	6	Do. 6 p.c. Cum. Pref.	117—122
Dec. 15	5	Do. 5 p.c. Irred. Deb.	117—122
Sept. 1	6⅞	East Wight Cons. Ord.	108—113
Aug. 18	5	Eastbourne 'A'	101—106
"	3½	Do. 'B'	98—103
Nov. 17	5	Gas Consolidation Ord. 'A'	20/6—22/6
"	5	Do. Ord. 'B'	20/6—22/6
"	4	Do. 4 p.c. Red. Cum. Pref.	17/6—19/6
Aug. 4	5	Gas Light & Coke Ord.	23/ —24/
"	3½	Do. 3½ p.c. max.	78½— 81½
"	4	Do. 4 p.c. Con. Pref.	99—102
Jan. 5	3½	Do. 3½ p.c. Red. Pref.	96½— 99½
Dec. 1	3	Do. 3 p.c. Con. Deb.	86— 89
"	5	Do. 5 p.c. Deb.	104—107
"	4½	Do. 4½ p.c. Red. Deb.	104—107
Sept. 1	3½	Do. 3½ p.c. Red. Deb.	94— 99
Aug. 4	5	Gloucester Cons. Ord.	94— 99
Feb. 11	4	Great Yarmouth (8½ p.c. max)	133— 143
Sept. 1	7½	Guildford Cons. Ord.	132—137
Aug. 18	5	Hampton C't, 5 p.c. Cons. Ord.	95—100
Sept. 1	5	Hartlepool G. & W. 5 p.c. Ord.	94— 99
Oct. 13	6	Hastings & St. L. (5 p.c. Std.)	100—105
"	5	Do. (3½ p.c. Std.)	87— 92
June 16	7½	Holyhead & N. Wales Ord.	20/6—22/6
Sept. 15	5	Hornsey 3½ p.c. Std.	89— 94
"	6⅞	Do. 5 p.c. Std.	110—115
May 19	8¾	Imperial Continental Cap.	110—115
Sept. 1	7½	Lea Bridge Co., Cons. Ord.	134—139
Aug. 4	5½	Liverpool 5 p.c. Ord.	121—126
Sept. 15	7½	Luton Cons. Ord. 'A'	152—157
"	6½	Do. Ord. 'B'	115—120

When last ex-Dividend.	Dividends Interest. Total for Year %	NAME.	Quotations Jan. 27
Jan. 5	7	Malta & Med'n., 7 p.c. 1st Pref.	110—115
"	7½	Do. 7½ p.c. 2nd. Pref.	110—115
Aug. 18	5⅗	M.S. Utility 'A' Cons.	102—107
"	3⅗	Do. 'B' Cons.	70— 75
"	5	Do. 'C' Cons.	102—107
"	4	Do. 4 p.c. Cons. Pref.	96 —101
May 19	2	Montevideo, Ltd. Ord.	95—100
Aug. 4	5⅜	Newcastle and Gateshead Ord.	24/9—25/9
June 30	3½	Do. 3½ p.c. Perp. Deb.	93— 98
Aug. 4	8½	Newport (Mon.) Cons.	98—103
Dec. 15	5	Do. 5 p.c. Perp. Deb.	110—115
Sept. 29	6½	North Middlesex 6 p.c.	123—128
"	5	Do. 5 p.c. Pref.	105—110
Aug. 18	5	Northampton Cons.	104—109
Aug. 4	9⅜	Oxford, Cons. Ord.	205—215
Dec. 1	5⅜	Plymouth & Stonehouse Ord	111—116
	8½	Do. Addl.	14½— 15½
	7½	Do. New	13½— 14½
Sept. 15	5	Do. 5 p.c. Deb. Perp.	118—123
Aug. 18	7½	Portsmouth & Gosport Cons.	147—152
"	5	Do. 5 p.c. max.	102—107
Aug. 4	10	Preston 'A'	178—183
"	7	Do. 'B'	125—130
June 24	46 2	Primitiva Holdings, Ltd. Ord.	9/ —11/
Dec. 15	6	Do. 6½ p.c. Red. Cum. Pref.	97—102
Aug. 18	5	Reading, 5 p.c. max.	97—102
	3⅜	Do. 3⅜ p.c. Red. (Non-Cum.) Pref.	96— 101
Dec. 15	4	Do. 4 p.c. Perp. Deb.	91— 96
Aug. 18	5	Romford, Ord.	110—115
Sept. 15	7½	Severn Val. Ltd. Ord.	22/3—23/3
	4½	Do. 4½ p.c. Cum. Pref.	20/6—21/6
Sept. 1	6½	Sheffield Cons.	143—148
Jan. 5	4	Do. 4 p.c. Red. Deb.	93— 98
Sept. 1	6	South East'n Gas Ltd. Ord.	22/ —23/
	4½	Do. 4½ p.c. Red. Cum. Pref.	20/9—21/9
	4	Do. 4 p.c. Irred. Cum. Pref.	19/—20/-
Aug. 4	5	South Metropolitan Ord.	103 —108
	6	Do. 6 p.c. Irred. Pref.	123 —128
	4	Do. 4 p.c. Irred. Pref.	97 —102
Dec. 15	3	Do. 3 p.c. Perp. Deb.	82 — 87
Jan. 5	5	Do. 5 p.c. Red. Deb.	97 —102
Aug. 4	5	South Suburban Ord. 5 p.c.	112 —117
	5	Do. 5 p.c. Perp. Pref.	108 —113
	4	Do. 4 p.c. Perp. Pref.	93 — 98
	3⅜	Do. 3⅜ p.c. Red. Pref.	90 — 95
Dec. 15	5	Do. 5 p.c. Perp. Deb.	118— 123
Sept. 15	5½	South West. G. & W. Ltd. Ord.	19/—21/-
Aug. 4	5	Southampton Ord.	102 —107
Aug. 18	6	Sunderland Ord.	113 —118
Aug. 4	4½	Swansea Ord.	83 — 89
	5½	Do. 5½ p.c. Red. Pref.	100 —105
Sept. 15	7	Swindon Cons. Ord.	114 —119
Aug. 4	5	Tottenham Ord.	116 —121
	5	Do. 5 p.c. Pref.	108 —113
	5½	Do. 5½ p.c. irred. Pref.	120 —125
Dec. 15	4	Do. 4 p.c. Perp. Deb.	95 —100
Oct. 13	6.85	Tunbridge Wells, 4 p.c. Sliding	122 —127
	7	U. Kingdom Ltd. Ord.	22/9—23/9
Nov. 17	4½	Do. 4½ p.c. 1st Cum. Pref.	22/3—23/3
	4	Do. 4 p.c. 1st Red. Cum. Pref.	19/ —20/
Jan. 5	4½	Do. 4½ p.c. 2nd Non-Cum. Pf.	19/ —20/
Sept. 15	3½	Do. 3½ p.c. Red. Deb.	93 — 7/8
Aug. 18	6⅝	Uxbridge, &c., 5 p.c. Cap.	120 —125
	5	Do. 5 p.c. Pref.	107 —112
	5	Do. 5 p.c. Perp. Deb.	118 —123
Dec. 1	5	Wandsworth Cons.	118 —123
Aug. 4	5	Do. 4 p.c. Pref.	97 —102
	4	Do. 5 p.c. Irred. Deb.	121 —126
Dec. 15	5	Do. 4 p.c. Irred. Deb.	94 — 99
	4	Watford & St. Albans Ord.	117 —122
Aug. 4	5	Do. 5 p.c. Pref.	107 —112
	5	Do. 5½ p.c. Pref.	120 —125
	5½	Weymouth Ord. (5 p.c. Basic)	92 — 97
	5	Woking District "A" Ord.	180 —190
Aug. 18	10¼	Do. "B" Ord.	127 —132
	7.35	Wolverhampton Cons. Ord.	119 —124
Aug. 4	7½	York Cons. Ord.	97 —102
Sept. 15	5		

DIVIDENDS

Newcastle upon Tyne & Gateshead Gas Company

The Directors have resolved to recommend to the proprietors, subject to audit, the payment on Mar. 1 of final dividends for the year ended Dec. 31, at £2%, less tax on the Preference stock, making 4% for the year; and at £2 17s. 6d.%, less tax on the ordinary stock, making £5 7s. 6d.% for the year.

Gas Light and Coke Company

The Directors of the Gas Light and Coke Company will recommend to the proprietors at the Ordinary General Meeting on Feb. 24: (a) the confirmation of the payment of a dividend for the half-year ended Dec. 31 on the 3¼% Redeemable Preference stock, 1970, at the rate of £3 15s.% per annum; and (b) the payment on Mar. 1 of dividends for the half-year ended Dec. 31 on the 4% Consolidated Preference stock at the rate of 4% per annum; on the 3½% Maximum stock at the rate of 3½% per annum; and on the Ordinary stock, 2½% (actual), making a total dividend of 5% for the year 1948. Dividends are in all cases subject to the deduction of tax.

PUBLICATIONS

Getting On Together (H.M.S.O., price 3d.) is a popular account of the European Economic Information Unit of the Recovery Programme, prepared by the Treasury, which in 16 pages of script, charts, and photographs gives a brief history of E.R.P., an account of its administrative machinery, notes on participating countries, the story of European co-operation, and that of American aid.

* * *

Holland & Hannen and Cubitts, Ltd., 1, Queen Anne's Gate, London, S.W.1, in conjunction with the British Colour Council have issued a leaflet on the scientific application of colour and illumination in the design of interior decoration for industry and commerce. At the same time, a small display in the form of a workshop illustrating the correct use of colour and illumination in industry has been opened at the Electricity Service Centre, Queen Street, London.

* * *

A second supplement to *Redgrave's Factories Act* (Butterworth, 7s. 6d.), by John Thompson and Harold R. Rogers, is intended to bridge the widening gap between the publication of the last edition of Redgrave and the new one which the authors are preparing. Among important enactments included are the Factories Act, 1948, Acts concerning education, hours of work, holidays, cleanliness, and the Patent Fuel Manufacture (Health and Welfare) Special Regulations.

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A handy and useful little reference book, *Refrigeration Notebook* (Leonard Hill, pp. 368, 10s.) by A. E. Miller, provides in text and table a practical source of information for refrigeration engineers. Developed from notes made and collected by the author during an extensive connexion with the refrigerating industry, it is valuable because it deals with actual practice rather than theory. The contents include information on the principles of heat transfer and refrigeration, notes on refrigerating plants and equipment, insulation, and applications. It deals thoroughly with refrigeration with gas in words and illustration and includes 67 useful tables, one of especial interest giving types of package, weights, storage temperatures, humidities, and storage periods for a long list of commodities.

The winter issue of *Smokeless Air*, the journal of the National Smoke Abatement Society, contains articles on how Pittsburgh, by stringent new regulations, is ridding itself of smoke, and how in this country Salford is the first city to plan to use similar principles. Pittsburgh's new ordinance prohibits the use of smoky coal in all domestic and other premises where mechanical firing is not provided. All fuel-burning equipment other than domestic requires an annual inspection and the issue of a certificate of operation, and new installations have to secure prior approval. The article on Salford reports steps to create smokeless zones in and around five of its post-war housing estates. When these zones are established it will be illegal to supply coal to any premises in the area, and tenants will have to use gas, electricity, coke, or other smokeless fuels for all purposes.

Certain Gas Undertakings, who participate in the "Gasco" Warning Service, receive forecasts of frost, snow, fog, temperature and other weather changes. It has been suggested that this service should be extended to the mean temperature for the next 48 hours and any abrupt changes during that period. A small extra charge would be made for this additional information. Undertakings interested in either the limited or the extended scheme have been invited to express their preference to the British Gas Council.

Perl Controls, Ltd., 672, Fulham Road, S.W.6, have appointed Mr. W. Melmoth, A.M.I.Mech.E., as their representative for the Midland area, and Messrs. Jas. R. Thomson & Co., Ltd., of Glasgow, as their representatives for the North of England and Scotland.

TRADE NEWS

Thos. W. Ward, Ltd., Albion Works, Sheffield, have taken over world sales distribution for Eldair Press Brakes and for the precision gauges manufactured by K. Emsley, Ltd., Bradford. They have also been appointed selling agents for Darling and Sellars 10½ in. centre Lathe throughout the world with the exception of Australia.

Matling, Ltd., announce their new "Pallet Truck." Very neat and compact, this truck is capable of a two ton load and its hydraulic mechanism quickly lifts pallet or stillage loads up to a weight of 4,500 lb. Where limited space is available, requiring extreme manoeuvrability, this truck seems ideal. It enables a pallet load to be pivotted on its own axis, and entry and exit to the pallet to be made at acute angles. The trials of the prototype have been completely satisfactory and the truck has been put straight into production.

A leaflet describing its 50 cwt. low lift and 30 cwt. load carrier "Electric Eel" industrial trucks has been published by Steels Engineering Products, Ltd., Crown Works, Sunderland. Outstanding feature of these trucks is the "instinctive steering" device which uses the natural directional movement of the body to control direction of travel. With its rugged construction and economical operation—"Electric Eels" draw their power from standard interchangeable batteries which can be charged at off-peak periods—these trucks offer versatile performance for a wide range of goods.

W. Edwards & Co. (London), Ltd., have produced a new catalogue dealing with the complete range of Speedivac pumps for the production of high vacua. Their rotary oil pumps have been improved further in the following directions: Reduced weight and overall dimensions, reduced oil charge, quiet running and improved pumping speed at low pressures given by a new stainless steel plate-type valve, oil level sight glass, oil spray arrestor, convenient oil draining arrangement, choice of demountable vacuum connexions to suit rubber pipe, coned metal and glass or permanent pipe connexions, and a specially designed moisture trap to suit particular fitting requirements.

Wessex Industries (Poole), Ltd., Dolphin Works, West Street, Poole, Dorset, are shortly putting on to the market the "Wrigley" light-weight motor truck which they have produced to meet the need for a lighter weight power driven unit at a price within the reach of the smaller operator in the industrial and agricultural field. With a normal carrying capacity of 5 cwt., on level ground, the "Wrigley" has a simplified construction from standard components, giving minimum operating and maintenance costs. It is claimed to handle bigger loads at a quicker rate than with a similar type of manually operated conveyance. Driven by a 1 h.p. four-stroke, air cooled petrol engine, the "Wrigley" does not need a skilled operator.

House Insulation

The importance of insulation in economical house heating has been stressed by the Department of Industrial and Scientific Research in the report published by the Royal Institute of British Architects on the house-heating trials at Abbots Langley, reference to which has previouly been made in the "JOURNAL." The overnight drop in temperature in a well insulated house is so much less than in an ordinary dwelling that the amount of fuel needed to raise the temperature to that required in the daytime is much reduced.

The Structural Insulation Association, National House, 14, Moorgate, London, E.C.2, has reprinted two leaflets of special interest to those concerned with this aspect of house warming. The first, entitled "How to Insulate Houses of Traditional Construction," says that the officially recommended standards for the thermal insulation of houses represents a very big advance over standard practice before the war, and that their universal adoption would mean a great improvement in comfort and a big contribution to the conservation of fuel supplies. It claims that the attainment of these new standards in all new houses is entirely practicable and to show how "simply and easily" they can be reached it presents a list of representative constructions.

The second leaflet presents a short survey of thermal insulating materials as an "initial guide" to those interested in this subject. Given in tabular form, the survey gives a general description of types of material, its weight in pounds per cu. ft., thermal conductivity, tells how it is supplied, what its standard sizes are, and its standard thicknesses.

The Structural Insulation Association was formed in 1946, with the encouragement of the Ministry of Fuel and Power, to provide a channel through which the specialized knowledge and experience of producers and importers of materials used for thermal insulation could be made readily available in the "fight for fuel."